Western Region

Sustainable Agriculture Research and Education

▪ 1996 ▪ ANNUAL REPORT

Western Region
Sustainable Agriculture Research and Education

Introduction From the Coordinator

This annual report documents the research, educational, professional development and outreach achievements of the Western Region Sustainable Agriculture Research and Education, SARE, program. The publication includes progress reports of funded projects that were submitted in early 1996. It also covers the competitive grants selection process and regional program activities of 1996.

It has been a very active and successful year for the regional program. Among other events during 1996, a new Farm Bill was crafted by the U.S. Congress that, once again, strongly mandated sustainable agriculture research and education. The SARE program also continued to receive level funding through a difficult federal appropriations process — due in large part to the work of farmers and ranchers and sustainable agriculture advocates from across the country, as well as the leadership and staffs of the national U.S. Department of Agriculture SARE office and the western regional program. As always, the unique, localized structure of the Western SARE program and the broad-based leadership of its Administrative Council are key elements of its effectiveness and longevity (see "About Western SARE" below).

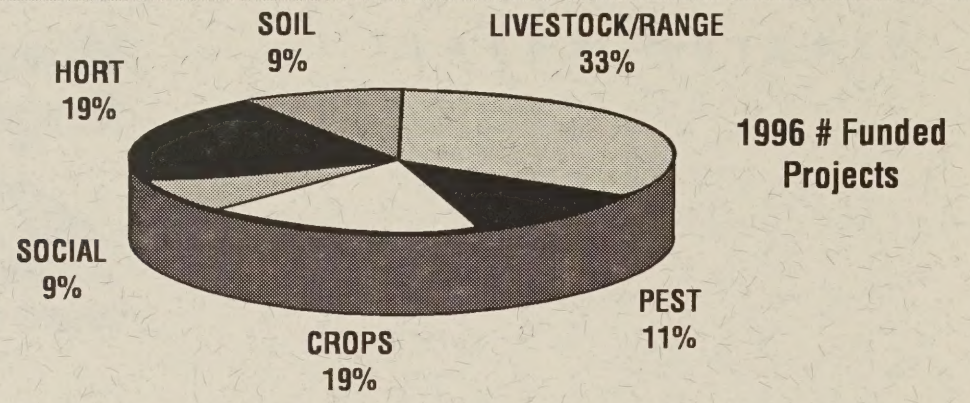
Western SARE administers four competitive grants efforts that are targeted to area producers, researchers, educators and agricultural professionals. They include: the Sustainable Agriculture Research and Education, SARE effort; the Agriculture in Concert with the Environment, ACE, grant program; the Professional Development Program; and the Farmer/Rancher Research Grant program.

Western SARE received record numbers of research, education and professional development project proposals in 1996. And, the program's portfolio of funded efforts continues to diversify, representing a broad mix of geography and subject matter in recent and current grant cycles. The slate of projects funded includes a good blend of sub-regional climates and topography, and sustainable agriculture topics and issues in the west. Roughly a third consider livestock operations, more than half investigate diverse crops and related production practices, and the rest cover economic, community-building and public lands and wildlife topics. (See following pie chart and text.)

In the overall 1996 grant selection cycle, nearly two million dollars in competitive awards were earmarked for universities, farmers and ranchers and organizations in the Western U.S. to further knowledge and adoption of sustainable agriculture. State-by-state (or Island territory) lists of grant recipients in 1996 and 1995 are provided in tables at the end of this publication.

Specific highlights of each grant program, and a major outreach effort to the region's key clientele follow.

- SARE and ACE Research Grants. The original Sustainable Agriculture Research and Education, SARE, grant effort began in 1988. A companion research program called Agriculture in Concert with the Environment, ACE, started in 1991 (through a cooperative agreement between USDA and the U.S. EPA) to test environmentally-sound agricultural practices. In this reporting year, 62 SARE and ACE proposals were submitted and 16 were funded, totaling more than $1.4 million in research grant funding. The following pie chart represents the diversity of project subjects selected this year.



- Professional Development Program. The Professional Development Program was initiated in 1994 to expand understanding of sustainable agriculture concepts and practices by agricultural professionals, including Extension and Natural Resources Conservation Service personnel. In 1996, seven new projects were funded after competitive review, totaling nearly $365,000. Another $200,000 was split among state Cooperative Extension programs in the west to further state-by-state strategic plans for sustainable agriculture professional development, and to build capacity for sustainable agriculture research and education at the state level. Also, a grant of roughly $60,000 was earmarked for a special initiative to support agricultural professionals in the Pacific Islands. This special project responds to directions from the U.S. Congress (as legislated in the 1996 Farm Bill) to target the timely sustainable agricultural needs of the tropical region. Among other activities, the professional development program coordinators also orchestrated a regional information-sharing conference of state extension sustainable agriculture leaders this year, held in concert with the Western Region Coordinating Committee on sustainable agriculture, WRCC-67, an assigned research coordinating committee of land-grant university representatives.
- Farmer/Rancher Research Grants. For the second year, competitive grants for area producers were made available. About $100,000 was split among 31 farmer- and rancher-initated projects in the Western U.S in 1996. A detailed section of this report, "Farmer/Rancher Research Grants," provides an overview of the program and background on funded projects selected in both 1995 and 1996.
- A Survey of our Stakeholders: Another major project in 1996 was the development of a opinion survey targeted to the region's key clientele, including: researchers and educators at land-grant universities; farmers and ranchers; university administrators; representatives of producer-member organizations; Cooperative Extension agricultural agents and advisors; among others. Primary goals of the survey were to identify the sustainable agriculture research priorities, information needs and learning preferences of these key populations to increase adoption in the region. The confidential mail survey was conducted by an outside, university-based market research service group. Survey results are expected to be released in mid-1997.

In cooperation with the U.S. Department of Agriculture Cooperative State Research, Education and Extension Service, thank you for your interest in sustainable agriculture and the progress of the Western SARE program. Following sections provide specific information about other items in this publication, and background on the Western SARE effort, its leadership and structure.

Sincerely,

V. Philip Rasmussen

V. Philip Rasmussen, Ph.D., regional coordinator

Western Sustainable Agriculture Research and Education

About this Annual Report Packet

This report provides "fact sheets" on active projects. The fact sheets outline the major objectives, results and potential benefits of funded research, education and professional development projects. The progress reports were written by project investigators and submitted to Western SARE for editing and publication in early 1996. Additional copies of fact sheets are available individually as well as in this complete package.

Also in this package are:

- Tables of recently-selected projects from each Western SARE grant effort (awarded in 1995 and 1996). These more recent projects will begin reporting results and accomplishments after one year of funded work. The tables are organized by state or Island Protectorate, with sub-totals of grant funds awarded in each territory;
- A Guide to Progress Reports that acts as a table of contents for research and professional development projects, organized by topic, to help you find projects of interest;
- A comprehensive resource list of regional and national SARE publications and informational materials developed by SARE-funded research and education teams. The list is organized by subject matter and provides contact and purchasing information; and,
- A "How to Apply for a Grant" page that tells you how to get on the mail list for calls for proposals or other regional mailings (with an attached mail information form you can send to the regional headquarters).

About Western SARE

The Western Region Sustainable Agriculture Research and Education, SARE, program is directed by a council of scientists, farmers and ranchers, business leaders and administrators, in cooperation with the USDA SARE office and the Cooperative State Research, Education and Extension Service.

Administrative Council members and officers in 1996:

- Jim Dyer, chair (term: August, 1995 to August, 1997), Dyer Environmental Consulting, Carbondale, Colorado
- Jerry Schickedanz, chair-elect (term begins August, 1997), New Mexico State University, Las Cruces, New Mexico
- Robert Heil, Colorado State University, Ft. Collins, Colorado
- Ralph Nave, USDA Agricultural Research Service, Albany, California
- Valerie Kelly, U.S. Geological Survey, Portland, Oregon (until December, 1996)
- Kathleen A. McCarthy, U.S. Geological Survey, Portland, Oregon (beginning January, 1997)
- Mike Somerville, state conservationist, USDA Natural Resources Conservation Service, Phoenix, Arizona
- Larry Thompson, farmer, Thompson Farms, Boring, Oregon

- Wilbur Wuertz, farmer, Coolidge, Arizona
- Ray Bernal, agricultural real estate consultant, Tucson, Arizona
- Kai Siedenburg, California Sustainable Agriculture Working Group, Santa Cruz, California
- Dennis Teranishi, agronomy consultant, Pacific Islands, Honolulu, Hawaii
- Ex Officio National Program Representatives: Rob Myers, SARE program director; Jerry DeWitt, Iowa State University, Extension Service representative; Harry W. Wells, ACE grants director, U.S. EPA.

An interdisciplinary group of research and extension scientists, the Western Region Coordinating Committee (WRCC-67), acts as an advisory committee to Western SARE. WRCC-67 meets annually to review research progress on sustainable agriculture in the west and to make recommendations to the Administrative Council about future directions of the Western SARE program. The advisory committee also acts as a "core" Technical Review Panel for the regional program's competitive grants process. The complete Technical Review Panel is appointed annually to correspond with the content of proposals to be reviewed in each grant effort. The panel includes farmers, ranchers, scientists, administrators and representatives of non-profit organizations and agri-businesses.

Since 1988 through fiscal 1996, the U.S. Congress has allocated more than **$69 million** to the federal SARE effort; Western SARE has received **$13.6 million in funds.**

The SARE program, which was authorized by Congress in the 1990 and 1996 Farm Bills, is managed regionally by four councils: Western, North Central, Northeast and Southern United States. These committees of scientists, producers and administrators represent a variety of interests and provide local leadership to research and training efforts. Regional councils operate in cooperation with the USDA SARE office and the Cooperative State Research, Education and Extension Service.

V. Philip Rasmussen, a soil scientist at the program's host institution of Utah State University, is the regional coordinator of Western SARE. The professional development effort is coordinated by Jill Shore Auburn, University of California, and Al Kurki of the National Center for Appropriate Technology, NCAT, Montana. The region includes Alaska, American Samoa, Arizona, California, Colorado, Guam, Hawaii, Idaho, Micronesia, Montana, Nevada, New Mexico, N. Mariana Islands, Oregon, Utah, Washington and Wyoming.

The **1997 grants cycle** began with the release of a call for research and professional development proposals on July 23, 1996. Technical and final reviews of proposals are done in Spring, 1997. Award announcements are expected to be made in late July, 1997.

This report was prepared by Kristen Kelleher, regional communications specialist, with editorial direction and review by V. Philip Rasmussen, Ph.D., Jill Shore Auburn, Ph.D. and Rhonda Miller, Ph.D. Graphic design by Marianne Post, UC Davis ReproGraphics.

How to Apply for a Grant

Western Region
Sustainable Agriculture Research and Education

Timelines for Grant Programs

Western SARE administers four grants efforts: the original Sustainable Agriculture Research and Education, **SARE**, program, which strives to expand scientific knowledge of sustainable farming and ranching practices; Agriculture in Concert with the Environment, **ACE**, a joint USDA / U.S. EPA effort to research practices that mitigate agricultural pollution; the **Professional Development Program**, which aims to educate agricultural professionals about sustainable agriculture; and, the **Farmer/Rancher Research Grant** effort, which supports producer-directed research and community development activities.

All grants programs operate on an annual (once-a-year), competitive selection process. General deadlines for calls for proposals and corresponding due dates follow.

SARE and ACE: a joint call for proposals is released in mid-summer; proposals due by mid-October.

Professional Development Program: call for proposals released in tandem with SARE/ACE in mid-summer; proposals due in mid-November.

Farmer/Rancher Research Grants: call for proposals released in November; deadline for submission in mid-January.

How to Receive a Call for Proposals

Calls for proposals are automatically bulk-mailed to those on the mail list at the time the call is released. To add your name to the distribution list, fill out and send the mail information form provided in this packet. If you prefer e-mail, contact the host office via e-mail at fnhinck@cc.usu.edu with the necessary information. It is particularly important to specify the type of information or grant effort in which you are interested.

Once you are on our contact list, you can also be included in informational mailings on research and program accomplishments, at your request.

To request grant application materials after a call for proposals has been released, contact the host office at Utah State University by writing: Western SARE, Room 322, Agricultural Science Building, 4865 University Blvd., Utah State University, Logan, Utah, 84322-4865. Via e-mail, contact fnhinck@cc.usu.edu. Or, call the Western SARE office at (801) 797-2257.

Calls for proposals — as well as research information, program accomplishments and more —are also available for down-loading from Western SARE's Web site at **http://ext.usu.edu:80/wsare/**.

For More Information

Western Region
Sustainable Agriculture Research and Education

The Western SARE program staff is available to answer your questions about the region's competitive grants efforts, and available publications and informational resources. The national SARE office and the Sustainable Agriculture Network (the SARE program's national outreach and information partner) are also available to serve your needs.

Host institution office (general and grants information)

Western Region SARE
Room 322, Agricultural Science Building
4865 University Blvd.
Utah State University
Logan, UT 84322-4865

V. Philip Rasmussen, regional coordinator
tel: (801) 797-2257
fax: (801) 797-3376
soilcomp@cc.usu.edu

Rhonda Miller, grants program manager
tel: (801) 797-0351
fax: (801) 797-3376
rlmiller@cc.usu.edu

Florence Hinck, administrative assistant
tel: (801) 797-2257
fax: (801) 797-3376
fnhinck@cc.usu.edu

Public information (and publications):

Kristen Kelleher, communications specialist
SARE
University of California
Davis, CA 95616
tel: (916) 752-5987
fax: (916) 754-8550
kkelleher@ucdavis.edu

Professional development program*

Jill Shore Auburn, regional training coordinator
SARE
University of California
Davis, CA 95616
tel: (916) 754-8548
fax: (916) 754-8550
jsauburn@ucdavis.edu
*to get on the program's mail list, contact the host office

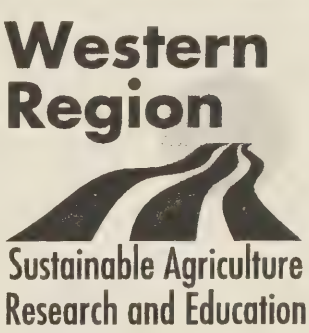
National SARE Contacts

Rob Myers
Director, SARE Program
USDA/CSREES
1400 Independence Ave. S.W.
Stop 2223
Washington, D.C. 20250-2223
tel: (202) 720-5834
fax: (202) 720-6071
e-mail: rmyers@reeusda.gov
(Valerie Berton, national SARE communications specialist, can be reached at (301) 405-3186 or via e-mail at vberton@wam.umd.edu)

Andrew Clark
Sustainable Agriculture Network Coordinator
c/o Alternative Farming Systems Information Center, Rm. 304
NAL/ARS/USDA
10301 Baltimore Blvd.
Beltsville, MD 20705-2351
tel: (301) 504-6425
fax: (301) 504-6409
e-mail: san@nal.usda.gov

Key Web Sites
Western SARE: **http://ext.usu.edu:80/wsare/**
SAN/national SARE: **http://www.ces.ncsu.edu/san/**

Mail List Request Form



Mail to:

Western SARE Contact List
Room 322, Agricultural Science Building
4865 University Blvd.
Utah State University
Logan, Utah, 84322-4865

Please fill out this form, then mail it to the address above.
For questions, call (801) 797-2257, or e-mail Florence Hinck at fnhinck@cc.usu.edu.

Name: _____

Dept./Title/Profession: _____

Institution/Organization/Company: _____

Address: _____

City, State, Zip: _____

Phone: _____

Fax: _____

E-mail: _____

Which type(s) of grant program(s) are you interested in? Check box(es).

— research and education?

— professional development for ag professionals?

— farmer/rancher research? (You must be a producer to apply for this grant effort.)

Are you interested in receiving regular or special informational mailings on Western SARE accomplishments and activities?

—yes —no

How would you best describe yourself, or the group you represent? Check one only.

— farmer

— rancher

— researcher

— Cooperative Extension (university-based)

— field agricultural professional (extension, NRCS, or other)

— sustainable agriculture organization

— general agricultural organization

— commodity organization

— environmental organization

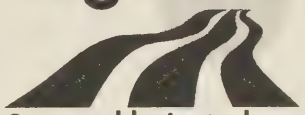
— policy maker

— educator (community college, K-12 instructor)

— member of the public

Sustainable Agriculture Resources

Western Region



Sustainable Agriculture Research and Education

The SARE program puts high emphasis on getting research results and practical information on sustainable agriculture to those who need it in a timely and useful fashion. Following are resources for information on sustainable agriculture, most of which were developed by or with support from Western SARE, the national SARE program, or the Sustainable Agriculture Network (the national outreach partner for SARE programs).

If follow-up information is not given, contact the Western SARE public information office at: (916) 752-5987, phone; (916) 754-8550, fax; or kkelleher@ucdavis.edu.

Western SARE also has calls for proposals, news releases, general and research information, and other resource referrals available on its Web site at **http://ext.usu.edu:80/wsare/**.

SARE PUBLICATIONS

To request any of these FREE publications, contact the Western SARE public information office.

- *Western Region SARE Annual Report, 1995*
- *Eight Years of Progress: 1988-1995.* An overview of eight years of accomplishments in the Western SARE program.
- *National SARE Project Highlights* (1997 and 1996 editions), including brief and colorful highlights of research across the nation.

SAN: PUBLICATIONS, DATABASES, INTERNET

To order any of the following Sustainable Agriculture Network, SAN, materials, send a check or purchase order (or written request) to: Sustainable Agriculture Publications, Hills Building, University of Vermont, Burlington, VT, 05405-0082. To inquire about bulk discounts and rush orders, phone (802) 656-0471 or e-mail msimpson@zoo.uvm.edu. For general information about SAN, contact coordinator Andy Clark at (301) 504-6425, or san@nal.usda.gov. National research and general information on USDA Sustainable Agriculture Research and Education efforts are also available on the **SAN/SARE Web site at: http:///www.ces.ncsu.edu/san/**

- *Profitable Dairy Options: Grazing • Marketing • Nutrient Management.* A brochure on sustainable dairy farming which focuses on rotational grazing, new marketing approaches and some references for feedlot-oriented systems. FREE.
- *The Sustainable Agriculture Directory of Expertise* (print or on computer diskette/Folio software). A list of over 700 people and organizations willing to share their expertise in sustainable agriculture. Price: $18.95

- *Source Book of Sustainable Agriculture Information and Educational Materials.* A national guide of handbooks, Web sites, newsletters, conference proceedings, bulletins, videos and more that focus on sustainable agriculture topics. The guide includes materials developed with SARE support, as well as resources from non-profits, universities and other organizations. Each of the more than 500 entries has a detailed product description and ordering information. Price: $12.00
- *The Real Dirt.* Farmers tell about organic and low-input practices in the Northeastern U.S. Price: $13.95

WESTERN REGIONAL NEWSLETTER

- *Sustainable Agriculture* (a publication of the University of California's Sustainable Agriculture Research and Education Program). This FREE newsletter provides practical information, announcements and technical and research summaries. For a list of other materials or to subscribe, contact UC SAREP at (916) 752-7556.

WESTERN SARE PUBLICATIONS, VIDEOS, GUIDES, HANDBOOKS & MORE: *ORGANIZED BY KEY TOPIC*

All of the following resource materials were developed with support from Western SARE regional grants, except the noted SAN publications.

Directories: Expertise, Materials

- *The Sustainable Agriculture Directory of Expertise* (print or computer diskette/Folio software). A list of over 700 people and organizations willing to share their expertise in sustainable agriculture. Price: $18.95 See SAN section above for ordering information. (SAN)
- *Source Book of Sustainable Agriculture Information and Educational Materials.* A national guide of handbooks, Web sites, newsletters, conference proceedings, bulletins, videos and more that focus on sustainable agriculture topics. The guide includes materials developed with SARE support, as well as resources from non-profits, universities and other organizations. Each of the more than 500 entries has a detailed product description and ordering information. Price: $12.00. (SAN)

Research Design and Community Participation

- *Farmer/Scientist Focus Sessions: A How-To Guide.* By Daniel Green-McGrath, Larry S. Lev, Helene Murray and Ray D. William. Order up to six free-of-charge. Contact: Publications Orders, Agricultural Communications, Oregon State University, Administrative Services, A422, Corvallis, OR, 97331-2119, or phone (503) 737-2513.
- *Whole Farm Case Studies: A How-To Guide.* By Helene Murray, Daniel Green-McGrath, Larry S. Lev and Alice Mills Morrow of Oregon State University. Order up to six free-of-charge. Contact: Publications Orders, Oregon State University at same address as above.
- *Participatory On-Farm Research and Community Involvement in Agriculture and Environmental Issues: An Annotated Bibliography,* January 1980 - May 1992
- *Facilitator's Guide to Involving the Public in Applied Agricultural Research: Planning and Coalition Building,* August 1992

- *Land Grant University Agriculture and Natural Resources Research: Perceptions and Influence of External Interest Groups*
- *Exploring the Unique Qualities of Sustainable Agriculture Research and Education.* Reference #MISC0178. FREE. Bulletins Office, Cooperative Extension, Cooper Publications Bldg., Washington State University, Pullman, WA, 99164-5912. Phone: (509) 335-2857.
- *Community Ventures: Partnerships in Education and Research.* A series of publications (costing $1.00 each) on participatory methods for working with and learning from diverse audiences. Contact: Bulletins Office (same address and phone number as above), Washington State University.

Producer Research

- *On-Farm Testing: A Grower's Guide.* Contact: Cooperative Extension, College of Agriculture & Home Economics, Washington State University, Pullman, WA, 99164-6420.

Pacific Northwest Agriculture

- *A Resource Guide to Sustainable Agriculture in Washington and Oregon.* A resource guide of more than 200 pages tailored to this region. No charge while supply lasts. Contact: Guide # EM8531, Publications Orders, Oregon State University, at Administrative Services, A422, Corvallis, OR, 97331-2119, or phone (503) 737-2513.
- *Farming For Profit and Stewardship, Sustainable Agriculture in the Pacific Northwest.* Proceedings of the West Cascade Conference for 1989, 1990, 1991.
- *Farming For Profit and Stewardship, Sustainable Agriculture in the Pacific Northwest, 1989.* Proceedings of the Tri-State symposium. Contact: Department of Agronomy and Soil Science, Washington State University, Pullman, WA, 99164-6420.
- *Issues in Sustainable Agriculture: A Study of Horticultural Producers in Western Oregon and Washington*
- *Whole Farm Case Studies of Horticultural Crop Producers in the Maritime Pacific Northwest.* Contact: Publications Orders, Oregon State University, Administrative Services, A422, Corvallis, OR, 97331-2119, or phone (503) 737-2513.

Cover Cropping

- VIDEO: *Creative Cover Cropping in Perennial Farming Systems.* How to use cover crops in orchards and vineyards to improve soil fertility, enhance pest control and provide other benefits. Price: $20. Contact: UC SAREP, University of California, Davis, CA, 95616, or phone (916) 752-7556.
- VIDEO: *Creative Cover Cropping in Annual Farming Systems.* Cover cropping in row and field crop systems. Price: $20. Contact: UC SAREP at same address as above.

Sustainable Farming and Ranching Systems

- VIDEO: *Pleasant Grove Farms: A Case Study.* A case study of a northern California family farm that has transitioned to sustainable practices. Length: 22 minutes. Price: $20. Contact: Reference # V/94-Z, Communication Services, 1441 Research Park Drive, Room 131, University of California, Davis, CA, 95616, or phone (916) 757-8980.
- VIDEO: *UC Sustainable Agriculture Farming Systems Project.* Length: 22 minutes. The video provides an overview of the long-term University of California, Davis-based sustainable farm-

ing systems project, including background on experimental design, the participatory research process and current findings. FREE. Contact: SAFS Project, Dept. of Agronomy & Range Science, University of California, Davis, CA, 95616. Phone: (916) 752-8940.

- *Sustainable Farming Systems Project Newsbulletin.* Reports emerging results from this long-term project, which is comparing organic, low-input and conventional production systems for key northern California crops, such as processing tomatoes. Contact: SAFS Project (at address and phone above). The bulletin is also available on the project's Web site at http://agronomy.ucdavis.edu/safs/home.htm.
- VIDEO: Taped presentation *of Sustainable Agriculture Telecast/Teleconference: Training our Trainers.* A videotape of the interactive teleconference that provided an initial overview of sustainable agriculture techniques and issues for professional development of agricultural professionals. Contact: Joe Hiller, University of Wyoming Cooperative Extension Service, at (307) 766-5479 or 766-2196.

Farm/Ranch Management, Economics, Marketing

- *1992 Alternative Crop Rotation Enterprise Budgets, Whitman County, Washington.* Contact: Department of Agricultural Economics, Department of Crop and Soil Sciences, Cooperative Extension, Washington State University, Pullman, WA, 99164-6420.
- *Western Farm Management Extension Committee, Total Resource Budget Compendium,* August 1992
- *Marketing Sustainable Agriculture: A Promoter's Toolbox.* Methods for encouraging the adoption of sustainable agriculture among growers. Length: 77 pages. Price: $14.00. Contact: Publication #3367, Agricultural Information & Publications, Communication Services, University of California, Davis, California, 95616-8511, or phone (916) 757-8930.

Dryland Farming

- *Long-Term Management Effects on Soil Productivity and Crop Yield in Semi-Arid Regions of Eastern Oregon,* November 1989. Contact: Paul E. Rasmussen, USDA - Agricultural Research Services, Columbia Plateau Conservation Research Center, P.O. Box 370, Pendleton, OR, 97801. Phone: (503) 276-3811.
- *Dryland Farming In The Northwestern United States.* Contact: Washington State University, Cooperative Extension, Pullman, WA, 99164-6420.
- *Amber Waves,* 1992. Contact: Bulletins Office, #XB1025, Cooperative Extension, Washington State University, Pullman, WA, 99164-5912.
- *Cereal-Legume Cropping Systems: Nine Farm Case Studies in the Dryland Northern Plains, Canadian Prairies, and Intermountian Northwest.* Contact: Alternative Energy Resources Organization (AERO), 25 So. Ewing, Suite 214, Helena, MT, 59601. Phone: (406) 443-7272.
- *Sustainable Agriculture in the Northern Rockies and Plains.* Contact: AERO at above address.
- *Prospects For Sustainable Agriculture in the Palouse: Farmer Experience and Viewpoints, 1990.* Contact: Washington State University, Pullman, WA, 99164-6420.

Soil Fertility

- *Proceedings of AERO's Soil-Building Cropping Systems Conference.* Contact: Alternative Energy Resources Organization (AERO), 25 So. Ewing, Suite 214, Helena, MT, 59601. Phone: (406) 443-7272.

Protecting Natural Resources

- *Washington Agriculture: Sustaining Water, Land and People, Clean Water for Washington.* Contact: Bulletins Office, #EB1634, Cooperative Extension, Washington State University, Pullman, WA, 99164-5912.
- *Protecting Ground Water From Agricultural Chemicals: Alternative Farming Strategies For Northwest Producers.* Contact: AERO, 25 So. Ewing, Suite 214, Helena, MT, 59601. Phone: (406) 443-7272.
- *Cover Crops for Clean Water.* Proceedings of an international conference. Edited by W. L. Hargrove; authored by J. R. Sims and A. E. Slinkard.
- *Cropping Strategies and Water Quality 1993 Annual Report*

Pacific Island Agriculture

- *Taro Production Systems In Micronesia, Hawaii and American Samoa.* Contact: L. Ferentinos and A. Vargo, American Samoa Community College, Pago, Pago, AS.
- *Sustainable Taro Culture in the Pacific, The Farmers Wisdom.* Contact: Pacific Agricultural Development Office, Tropical Energy House, East-West Road, University of Hawaii, Honolulu, HI, 96822. Fax: (808) 956-6967.
- VIDEO: *Nourish The Roots Gather The Leaves - Sustainable Taro Culture in the Pacific.* American Samoa Community College, Pago, Pago, AS.

Ranching, Livestock/Crop Systems, Dairy

- *Profitable Dairy Options: Grazing • Marketing • Nutrient Management.* A brochure on sustainable dairy farming which focuses on rotational grazing, new marketing approaches and some references for feedlot-oriented systems. FREE. For ordering information, see SAN section above. (SAN)
- *Proceedings of Livestock Health and Nutrition Alternatives: A Western States Conference.* Contact: AERO at 25 So. Ewing, Suite 214, Helena, MT, 59601. Phone: (406) 443-7272.
- *Sustainability of Range Livestock Production Systems in the West,* proceedings of a September, 1994, regional conference. Sponsored by Montana State University, MSU Extension and Western SARE.
- *Crop and Livestock Production Systems for Land in the Conservation Reserve Program, 1994 Progress Report,* New Mexico State University Cooperative Extension and Agricultural Experiment Station. Contact: Rex Kirksey, New Mexico State University, Agricultural Science Center, 6502 Quay Road, AM.5, Tucumcari, NM, 88401.
- *Intermountain Workgroup "How To" Monitor Rangeland Resources, (Level 1, Beginning),* University of California Cooperative Extension, December, 1994. Contact: UCCE, County of Tehama, P.O. Box 370, 1754 Walnut Street, Red Bluff, CA, 96080. (Note: "Level 2, Advanced" is due for release in 1997)
- *Nutrient Management for Dairy Production: Dairy Manure as a Fertilizer Source.* Extension Bulletin #EM 8586, Oregon State University Extension Service, Corvallis, OR.

Pest Control

- AUDIO TAPE: *Habitat For Diversity and Pest Control.*

Agroforestry

- VIDEO: *Fire & Water Restoration of a Pinyon-Juniper Watershed.* Contact: USDA Soil Conservation Service, RC&D Program, Box 457, Carrizozo, NM, 88301. Phone: (505) 648-2941.
- *Restoration of A Pinon-Juniper Ecosystem* (Companion to Video). Contact: USDA Soil Conservation Service at above address.

Social Science & Sustainable Agriculture

- VIDEO: *"Social Capital and Sustainability:" The Community and Managing Change in Agriculture.* Price: $20 (plus $5 shipping charge). Contact: North Central Regional Center for Rural Development, Iowa State University, 404 East Hall, Ames, IA, 50011. Phone: (515) 294-8321.

Permaculture

- *"Permaculture-Sustainable Farming, Ranching, Living...by Designing Ecosystems that Imitate Nature,"* Central Rocky Mt. Permaculture Institute. Contact: Jerome Osentowski, Central Rocky Mt. Permaculture Institute, P.O. Box 631, Basalt, Colorado, 81621, (970) 927-4158. Internet: http://sunsite.unc.edu/london/permaculture.html.

Solorization

- AUDIO TAPE: *Perspectives on Solarization.*

Electronic and Internet Resources

- Western SARE Web site at **http://ext.usu.edu:80/wsare/**. Western SARE has calls for proposals (ready for down-loading), news releases, general and research information, and other resources available at this site.
- **SAN/SARE Web site at: http://www.ces.ncsu.edu/san/.** Nation-wide research and general information on USDA Sustainable Agriculture Research and Education efforts are available at this site.
- **Sanet-mg.** An electronic-mail discussion group of about 800 scientists, educators, producers and administrators from across the nation, which is sponsored by SAN. Through interactive questions-and-answers or general discussion, participants can find specific information and learn about sustainable agriculture approaches in diverse settings. To subscribe to **sanet-mg**, send the message *subscribe sanet-mg* to almanac@ces.ncsu.edu.

Farmer/Rancher Research Grants

Western Region
Sustainable Agriculture Research and Education

In 1995, Western SARE released its first call for farmer/rancher research grant proposals. The program makes producers and producer groups residing in the Western U.S. eligible to compete for grants of up to $5,000 each to identify, evaluate and test sustainable agriculture practices and challenges. A second competitive grants cycle was completed in 1996.

Combining the results of the 1995 and 1996 competitive grants processes, nearly 60 producer-directed research projects have been funded since the program's inception. Selected, "in-the-field" research projects are taking place in every part of the western region — including Alaska; American Samoa, Guam and other Pacific Islands; the Pacific Northwest states; the Intermountain region; the high northern plains states of Montana and Wyoming; California; and the southwestern states of Arizona and New Mexico.

The effort gives farmers and ranchers direct access to research and education funds authorized by the U.S. Congress to further the adoption of sustainable agriculture.

Grant proposals are reviewed and evaluated by a diverse group of producers, researchers, educators and administrators who are familiar with sustainable agriculture. Final selections are made by an appointed panel, at least half of which are producers. All funding is awarded competitively.

Grant reviewers look for potential projects that clearly define local sustainable agriculture problems or issues and propose innovative solutions. On-farm tests of suggested technologies and approaches are strongly encouraged. All research proposals must be led by one or more producers, include a professional agricultural technical advisor (an extension agent or university researcher, for example), and provide a plan for sharing gained information with others in the community.

Following is a list of active farmer/rancher research efforts, organized by state or territory. *The project summaries provided are taken directly from grant proposals written by producers.*

To request more background on this program or find out how to apply for a grant, please see "How to Apply for a Grant." Past and current calls for proposals, and other information is always available on-line via the Western SARE Web site at http: //ext.usu.edu: 80/wsare/.

1995 FARMER/RANCHER GRANTS

Alaska

Establish More Efficient and Biological Practices for Bringing Forest Land into Agricultural use through Sustainable Development using Indigenous Species in Alaska
Producer: Vickie Talbot
Location: Trapper Creek, Alaska
Grant Award: $5,000
Summary: The project is two-fold: 1) To reclaim valuable timber resources which were piled into windrows as a means to clearing forest land for agricultural use. 2) To establish, by using rotted birch and spruce mulch from the windrows as soil conditioners, a commercial lingonberry stand along with other native type and indigenous berries.

American Samoa

Composting Farm and Kitchen Wastes in American Samoa
Producer: Juan Chan
Location: Pago Pago, American Samoa
Grant Award: $721.41
Summary: This project plans to determine the feasibility of composting farm and kitchen wastes in tropical Samoa. There are two obstacles to overcome: 1) a statute prohibiting heaps of decayed rubbish, grass or leaves to deny breeding sites for the rhinoceros beetle, and 2) composting is alien to Samoan farming practices. This project will determine if the expense, labor, and time commitment for this practice are worthwhile.

Development of a Sustainable Agroforestry System
Producer: Malo Palesoo
Location: Tutuila, American Samoa
Grant Award: $2,765

Controlling the Banana Scab Moth Caterpillar in American Samoa Through Cultural Methods
Producer: Fetalai Lefee
Location: Pago Pago, American Samoa
Grant Award: $1,400
Summary: This project plans to test a cultural method for controlling one of the serious pests of bananas in American Samoa, the scab moth caterpillar. The method involves adopting a vigilant program of spreading the brachts of the banana flower soon after the flower bends down from its "pointing up" position. The method would be an alternative for the use of pesticides and save money as well.

California

Monitoring Program for Biologically Integrated Orchard Systems (BIOS) in Walnuts
Producer: Liza Lewis,
Walnut BIOS Management Team
Location: Davis, California
Grant Award: $5,000
Summary: Currently, conventional walnut production in California is marked by relatively heavy use of synthetic N fertilizer, herbicides and insecticides. Information is needed on how alternative biological practices work on different soil types, walnut varieties and irrigation practices. A specialized monitoring program will provide more hands-on, in-field information for the growers. Enriched with a deeper understanding of walnut orchard ecology, growers will ultimately be provided with more tools for sustainable orchard management.

Colorado

Evaluation of Alternative Crops in Dryland Multi-crop Rotations on Farms in the Northeastern ColoradoRegion
Producer: Joe Kinnie
Location: Julesburg, Colorado
Grant Award: $5,000

Idaho

Biological Control in Idaho Alfalfa Seed Fields
Producer: Larry Sorenson
Location: Parma, Idaho
Grant Award: $5,000
Summary: Lygus bugs are the most important pest of alfalfa, killing the buds and damaging the seed, along with other pests such as aphids, thrips, and mites. As more regulations, loss of chemicals, more urbanization, higher responsibility and liability to applicators grow, a biocontrol program for these pests may be a step forward for this crop and others. This project plans to demonstrate that biocontrol is an effective and feasible alternative option to pesticides for other growers.

Squash Bug Management Through Introduction of Game Birds
Producer: Jill Kohler
Location: Eagle, Idaho
Grant Award: $2740
Summary: The proposal is to create pens for game birds in a summer and winter squash growing area to control squash bugs. Other program benefits are increased soil fertility, weed management, and a new cash crop. Although the project is tested on a small scale crop, other farmers, large or small, should benefit from this research.

Row Spacing Effect on Weed Suppression
Producer: Lee Griffiths
Location: Blackfoot, Idaho
Grant Award: $530
Summary: The project plans to demonstrate the feasibility of reducing weeds in spring wheat by comparing a normal seed rate and normal spacing with increased seed rate and double drilling. Winter wheat stands suppress weeds because a dense cover is formed before weeds can develop. If it can be demonstrated that closer spacing or double drilling can significantly reduce weed pressure, producers may be able to reduce herbicide applications.

Developing an Idaho-Based Marketing Cooperative for Sustainably and Locally Grown Produce
Producer: Janie Burns
Location: Nampa, Idaho
Grant Award: $4,622
Summary: This project will address a critical problem facing sustainable agriculture: the marketing and distribution of locally-grown products produced with sustainable practices. The project will assess the need and interest in forming a cooperative for sustainably grown products in Idaho.

Montana

Carter-Fallon Forage Committee Range/Livestock Project
Producer: Randy Tunby
Location: Baker, Montana
Grant Award: $4,943
Summary: The proposal follows up a previously funded project continuing range research. The study will be continued to obtain longer term information on eight alfalfa varieties with the data including production, stand density, and longevity. Also the study will be extended for alfalfa and alfalfa seed depredation by wildlife which is nature dependent and subject to change. Further study will define interactions between livestock and wildlife, and determine diets and diet composition of wildlife.

Managing a Living Mulch System in an Intensive Organic Vegetable Cropping Operation to Enhance Weed, Nutrient, and Pest Management
Producer: Helen Atthowe
Location: Stevensville, Montana
Grant Award: $5,000
Summary: This study will investigate the effects of shallow cultivation and mowing as well as the timing of living mulch manipulations on nutrient availability, soil organic matter content, and weed population size. Soil microbe and beneficial insect population levels will be monitored to assess the effects of living mulch manipulation techniques on long term soil quality and biological pest management enhancement.

Influencing Elk and Livestock Riparian Use
Producer: Allen Carter
Location: Livingston, Montana
Grant Award: $4,750
Summary: The project plans to test different strategies to reduce grazing in riparian areas. In some areas wildlife and livestock overuse riparian areas while uplands are underutilized. This project will demonstrate some strategies to manage riparian areas by using cross-riparian drift fences and fertilized upland plots.

New Mexico

Test Plot Demonstration for Organically Produced Small Grains
Producer: Lonnie Roybal
Location: Taos, New Mexico
Grant Award: $5,000

Municipal Sludge and Legumes as Soil Builders
Producer: Pete Tatschl
Location: Tucumcari, New Mexico
Grant Award: $4,290

Gila Permitees Association Elk Study
Producer: Matt Schneberger
Location: Winston, New Mexico
Grant Award: $5,000
Summary: The aim of this project is to study the effects of elk herds on riparian areas. Currently, owners of grazing permits on national forests have no information concerning elk-livestock integration and the impact it has on the rancher's ability, in an agriculturally sustainable manner, to graze cattle on riparian areas.

Oregon

Evaluating Methods to Enhance Microbial Degradation of Residual Soil Contaminants
Producer: J.J. Haapala
Location: Junction City, Oregon
Grant Award: $5,000
Summary: This project proposes an investigation into effective techniques to prevent contamination of plant tissue and degrade organochlorine soil contaminants. This study into on-site bioremediation offers the opportunity to deepen understanding of the relationship between farming techniques, soil microorganisms, and residual soil contaminants.

Parasite and Nutrient Management of Composted Manure
Producer: Glenna Wilder
Location: Cornelius, Oregon
Grant Award: $1,225
Summary: Using manure to fertilize pastures grazed by the animals that produced the manure, potentially increases the parasite load of those animals. Composting is recommended to reduce manure parasite populations. This project will monitor the composting process and results, providing guidelines and recommendations to produce an end product that has little or no parasite potential, with beneficial nutrients for fertilization.

Low Tillage Weed Control System
Producer: Jim Fullmer
Location: Philomath, Oregon
Grant Award: $1,600
Summary: This project will look at developing soil humus with weed control accomplished in a sustainable manner with as little tillage as possible. In addition to conserving soil organic matter, such an approach to weed control also reduces degradation of soil structure due to rain and irrigation, as well as soil loss through erosion. The concepts investigated here could be applicable to many perennial farming systems requiring in-row and between row weed control.

Demonstration and Implementation of Integrated Fruit Production on Anjou Pears
Producer: Thom Nelson
Location: Odell, Oregon
Grant Award: $5,000
Summary: The objectives of this study qre: 1) to research, demonstrate and implement an integrated fruit production program for pears; 2) to evaluate the short term as well as long term costs and benefits of integrated versus conventional pear production; and 3) to promote the adoption of integrated production practices through demonstration orchards, grower training, educational material, and development of integrated fruit production guidelines.

Utah

Pasture Aeration and Fertilizer Study
Producer: Ken Carter
Location: Mt. Home, Utah
Grant Award: $2,480

Summary: The project proposes a field trial to be conducted that will monitor the effects of aeration only, fertilizer only, and aeration with fertilizer on improving native pasture production. Documenting these effects would provide vital information to area livestock producers of similar pasture and to other producers throughout the state.

Washington

Relay / Cover Crop for Corn
Producer: Jerry Van der Veen
Location: Mt. Vernon, Washington
Grant Award: $5,000
Summary: The aim of this project is to test and demonstrate a method for establishing winter cover crops on ground used for field corn. Currently, by the time cover crops are planted in late fall, they cannot establish enough growth because it is too late in the growing season. A potential solution that this project will look at is to plant shade tolerant Italian rye as a relay/cover crop between corn rows during the growing season. Also, research has been done to determine the most shade tolerant and winter-hardy relay crops, but has been no testing for manure application upon these relay crops.

Managing Riparian Areas with Remote Livestock Watering Facilities
Producer: Craig Boesel
Location: Winthrop, Washington
Grant Award: $5,000
Summary: This project will construct a remote livestock water facility to mitigate livestock impact on riparian areas. A livestock watering system of a solar pump, pipeline, cistern, and trough will be used. Livestock producers and others interested will tour the project to learn more about riparian and upland watershed management.

Intensive Grazing in Asian Pear Orchards
Producer: R. Bruce Gregory
Location: Friday Harbor, Washington
Grant Award: $898.50
Summary: In this project, the grower will design and install a high tensile electric fence system to be installed onto posts of an established Asian pear palmette trellis system to allow management intensive grazing of sheep within the orchard. In addition, the grower will establish additional Asian pear plantings on palmette trellis outside of existing sheep/deer perimeter fencing to trial the new fencing system in open pasture areas currently available to rotational grazing by sheep and native deer. Mowing will be eliminated allowing a more sustainable environment for animal, insect, forage, orchard community and better utilization of water resources.

Wyoming

FLITNER Wetland Habitat Enhancement Project
Producer: Stan & Mary Flitner
Location: Greybull, Wyoming
Grant Award: $5,000
Summary: The project plans to remediate and enhance wetland area and pond available for waterfowl, wildlife, fish, and amphibians. This will be accomplished by creating a diversion from a nearby creek to purify the water. The resulting increase in fish, wildlife, and production will raise returns from forage, hunting, and fishing to offset the management costs of the wetland project on a long-term basis.

Integrated Management to Improve Rangeland Health and Reduce Noxious Weeds
Producer: Ogden Driskill
Location: Devils Tower, Wyoming
Grant Award: $5,000
Summary: The primary goal of this project is to make the Bearlodge Cattle Company near Devils Tower, Wyoming ecologically and economically sustainable. A second, closely-related goal is to improve over-all rangeland health and productivity on the ranch and to reduce the infestation of noxious weed leafy spurge. These goals will be accomplished through implementation of a management plan that integrates all ranch resources.

Initiation of Integrated Management
Producer: Tom Bruce
Location: Newcastle, Wyoming
Grant Award: $5,000
Summary: The purpose of this grant is to demonstrate the Western Integrated Ranch/Farm Education (WIRE) management process on a working ranch. This project will explore realistic strategic goals for the operation; inventory available resources in the human, financial, range, livestock, and wildlife areas; develop a management plan for those resources which will support the strategic goals developed; and explore various management and production practices to accomplish the management plan and provide an acceptable quality of life for those depending on the ranch.

1996 FARMER/ RANCHER GRANTS

Alaska

Establish more Efficient and Biological Practice for Bringing Forest Land into Agricultural use through Sustainable Development using Indigenous Species in Alaska
Producer: Vickie Talbot
Location: Trapper Creek, Alaska
Grant Award: $3,000
Summary: This project is a continuation for a current project with an added component. The new objective is: to use other species to develop a beneficial interrelationship of plants to provide an improved growing environment and natural weed control. Ongoing objectives include: 1) to reclaim valuable timber resources which were piled into windrows as a means of clearing forest land for agricultural use; and 2) to establish, by using rotted birch and spruce mulch from the windrows as soil conditioners, a commercial lingonberry stand along with other native type and indigenous berries.

American Samoa

Pig Manure Control and Utilization Project
Producer: Tovia Tuli
Location: Pago Pago, American Samoa
Grant Award: $5,000
Summary: This waste management project will convert a nuisance and environmental problem material to a useable and valuable input to another sector of the farm. Pig manure has been identified as a major cause of ground and coastal water pollution, at the same time fertilizer for crops is very expensive. This project will demonstrate a potential solution for both problems to the farmers of American Samoa and to other people of this region.

Arizona

Moving Succession Forward in a Lehmann Lovegrass Monoculture
Producer: Steve Getzwiller
Location: Benson, Arizona
Grant Award: $3,000
Summary: Many acres of land in southeast Arizona are dominated by Lehmann Lovegrass that establishes well in formerly bare areas, but does not provide a high protein diet for domestic livestock or the diverse habitat necessary for wildlife. The objective of this project is to see if succession can be accelerated to improve biodiversity for domestic animals and wildlife. The project proposes two different sites for demonstration applied during the winter months: 1) broadcast grass hay for animals to incorporate into ground, supplement with minerals; and 2) hand broadcast native perennial seed before the animal impact and feeding.

Goal-Driven, Intensive Management of a Riparian/ Sandy Bottom Site
Producer: Kali Holtschlag
Location: Dragoon, Arizona
Grant Award: $4,310
Summary: Much of the west's landscape has deteriorated. One approach to improve the land is to rest riparian areas long-term or even permanently. Without eliminating rest, or any other tool, this project will investigate if tightly managed livestock impacts, controlled by strict monitoring of conditions and guided by our goals, can improve this type of area for all its functions.

Managing Biological Processes for Maximum Diversity and Productivity
Producer: Mike Mercer
Location: Benson, Arizona
Grant Award: $2,500
Summary: Understanding how vegetative cover depends on the organic content of the soil, and learning how to increase soil organic matter, is crucial in improving desertified rangeland. This project proposes to hold classes with the help of recognized instructors to provide hands on learning of: 1) holistic planning for biological resource management; 2) how to increase the organic content of the soil to improve its permeability and plant sustainability; and 3) improving land health while maintaining herd health and production, and realizing a profit.

California

Farming, Agriculture, and Resource Management for Sustainability (F.A.R.M.S.)
Producer: Craig McNamara
Location: Winters, California
Grant Award: $5,000
Summary: The goal of this project is to develop an on-farm student research program which: 1) familiarizes 30 high school science and agriculture students with sustainable agricultural practices; and 2) allows these students to develop research projects that determine solutions to challenges and problems facing walnut producers. The F.A.R.M.S. program combines science, agriculture and education in an effort to expand agricultural outreach efforts into youth education.

Colorado

Habitat Management as a Transitional Tool to an Insecticide Free Pest Management Program in Apples
Producer: Bob White
Location: Hotchkiss, Colorado

Grant Award: $1,500
Summary: This project investigates an approach to the control of secondary insects in apple orchards by attracting and encouraging natural enemies through the planting of floral islands within the orchard. The results of increased populations of predators in the orchards will help reduce or eliminate the use of insecticides. This will protect the environment, assure the safety of growers and workers, reduce the need for purchase of expensive chemicals, and create a positive market identity.

Guam

Dry-Extrusion of Wet Garbage for Swine Feeding
Producer: George Pangelinan
Location: Yigo, Guam
Grant Award: $4,350
Summary: This study will examine dry-extrusion of wet garbage to alleviate problems associated with wet garbage feeding in swine. Problems of wet garbage feeding range from disease transmission to human and swine, cleanliness and sanitation on the farm, and it is laborious and time-consuming. The nutritional analysis of the dry- extruded feed will serve as a basis as to what other local feedstuff and feed supplements are needed to come up with a balanced ration for feeder pigs and breeders.

Vegetable Soybean Cultivator Trials
Producer: Felix Quan
Location: Tamuning, Guam
Grant Award: $3,020
Summary: There is great market potential for the soybean vegetable for Guam's local use and for export as a frozen vegetable to neighboring countries. In Guam, vegetable soybeans have not been grown commercially. In this project, cultivars and breeding lines of vegetable soybeans suitable to the tropical climate of Guam will be selected in two locations in Guam.

Hawaii

Sustainable Greenhouse Tomato Production: Evaluating Alternatives to Pesticide Use for Controlling Tomato Pinworm Larvae in Hawaii
Producer: Shari Tresky
Location: Hakalau, Hawaii
Grant Award: $3,520
Summary: The objective of this project is to compare lower input and less environmentally harmful methods for controlling Tomato Pinworm. This project hopes to help farmers in the western region by describing alternatives to toxic pesticides for control of Tomato Pinworm.

Idaho

Economic Viability of Greenhouse Solarization
Producer: Larry Higgins
Location: Sandpoint, Idaho
Grant Award: $2,450
Summary: This project will present a safe, natural way of controlling fungus and pests without chemicals by changing greenhouse management to include a sterilization program through solarization. To make the switch profitable, heat costs will have to be minimized which will be achievable through insulating, adding heat retaining water mass and double glazing.

Montana

Green Manure / Cover Crop Combination Experiment
Producer: Rod Daniel
Location: Grantsdale, Montana
Grant Award: $1,923.15
Summary: The major benefit of green manures in crop rotations is the addition of organic matter to the soil resulting in the improvement of soil structure, increased soil biological activity and enhanced nutrient availability to the subsequent crops. This project will compare six different green manure/ cover crop combinations using two variables: 1) the effect on nutrient availability and organic matter; and 2) the effect on weed suppression.

Evaluation of Grass Species for Improved Pasture Management
Producer: Robert Lee
Location: Judith Gap, Montana
Grant Award: $4,800
Summary: Proper grazing management of both tame and native pastures, during all seasons of the year, is a challenge for most beef cattle producers. This project will evaluate a variety of introduced and native grass species on several different sites to determine which species would offer the best palatability, productivity, and ground cover at different times of the year.

Legume Grazing in Rotation with Small Grains
Producer: Jess Alger
Location: Denton, Montana
Grant Award: $4,000
Summary: This study will compare legume grazing in rotation with small grains to continuous recropping of small grains and also to conventional farming. Legumes will be grazed in the traditional summer fallow year between grain crops. The added value of the cattle grazing on the legumes will be studied to see if this approach is economically feasible and a better alternative to current methods.

Vegetative Changes through Alternative Water Sources
Producer: Dale Veseth
Location: Malta, Montana
Grant Award: $2,500
Summary: In the study area, wildlife have become dependent on man-made livestock water sources for water and habitat. Because of livestock impact on the shorelines, wildlife habitat may be decreasing from a reduction in riparian vegetation, and animal impact may be increasing total dissolved solids in the water. Because of these problems, this project proposes to put livestock watering tanks next to reservoirs and pits to test if that, given a choice, livestock will drink out of the tank instead of the reservoir. The result will be increasing water quality, riparian vegetation and wildlife habitat.

New Mexico

Increasing the Value of Irrigated Pastures
Producer: Darrell Baker
Location: Tucumcari, New Mexico
Grant Award: $4,200
Summary: This project will aim to show that irrigated pasture can be a high value crop. The plan is to construct and operate a seasonal- milking, grass-based goat dairy. This project will explore a non-traditional marketing technique of turning grass into milk and it will show that irrigated pasture can be a high value crop, well suited to local condition and environment.

Test Plot Demonstration for Organically Produced Small Grains, Phase II
Producer: Lonnie Roybal
Location: Costilla, New Mexico
Grant Award: $5,000
Summary: Further trials will be done on a previously funded project to continue experiments on organically produced oat, barley, and wheat. If sucessful, additional results could provide more proof to area residents that the endeavor is successful. The project plans will help local farmers decrease dependence on government programs and further enable them to sustain themselves.

Oregon

School Cafeteria Compost System for Soil Amendment Production
Producer: Devon Strong
Location: Ashland, Oregon
Grant Award: $3,000
Summary: The goal of this study is to develop and implement a sustainable amendment production program using local schools' compost materials to produce amendments for incorporation on row crops for tilth and fertility improvement. Recycling loop of compost to production of sustainable agriculture will be demonstrated to local farmers and schools as well as nationally through the Healthy School Lunch Program.

Grazing Sheep in New Forest Plantings
Producer: Tom Lehman
Location: Corbett, Oregon
Grant Award: $1,575
Summary: In an effort to reduce the use of herbicides in new forest plantings by utilizing sheep, this project proposes to build a moveable sheep shelter with attached guard dog quarters. This project will greatly benefit the private forest owner in releasing the young seedlings from brush competition without pesticides, and also produce meat and fiber.

Low Tillage Weed Control
Producer: Jim Fullmer
Location: Philomath, Oregon
Grant Award: $1,895
Summary: Building on a previously funded project, this study will continue to develop a weed control system that reduces the need for tillage.

The Effect of Aerated Compost Teas on Disease Control in Blueberries and Tomatoes
Producer: Jack Gray
Location: Noti, Oregon
Grant Award: $2,610
Summary: This project will look at the effects of aerated compost teas on controlling late blight in tomatoes and Botrytis in blueberries and the subsequent impact on plant vigor and fruit quality. The results of this project combined with those of two other compost tea projects from the area will create a great deal of information for a broad range of crops.

Use of an Aerated Compost Tea as a Preventive Foliar Fungicide on Grape Vines
Producer: Dave Michul
Location: Eugene, Oregon
Grant Award: $2,930
Summary: There has been substantial scientific literature as well as practical agri-industry applications showing the positive effects of controlling powdery mildew in grapes with compost teas. This project will attempt to identify whether aerated compost teas made from winery waste products and animal manure can be an effective pest management tool, at what concentrations they achieve control, what effect they have on the soil biosphere within the treatment area, and what if any effects these teas have on vine physiology and wine quality.

Use of Aerated Compost Teas for Control of Foliar Diseases of Spinach, Lettuce, and Broccoli and to Promote Plant Vigor and Quality
Producer: William Booth / Debra Martin
Location: Blachly, Oregon
Grant Award: $2,620
Summary: This project will evaluate if aerated compost teas can be an effective pest management tool and what effect aerated compost teas have on the quality of vegetable production. Identification of the benefits of aerated compost teas will have major benefits to the organic vegetable producing growers in Oregon who face current production problems.

Washington

Carrot Rust Fly Control
Producer: Betsie DeWreede
Location: Rochester, Washington
Grant Award: $1,150
Summary: Carrot rust-fly is a major pest affecting carrots in southwest Washington. The only alternatives to pesticides are 1) delayed planting and 2) row-covers, but both lower economic efficiency of the crop. This project will test the use of a Medic intercrop as a deterrent to rust-fly.

Alternative Crop Production in a "Direct Seed Annual Crop Intense Rotation Program"
Producer: Karl Kupers
Location: Harrington, Washington
Grant Award: $4,400
Summary: This study will address erosion, both wind and water, that occurs during periods of summer fallow in the Pacific Northwest. This project will investigate alternative crops in a continuous direct seeding (no-till) cropping practice that eliminates summer fallow. Another goal of the project is reduced inputs which will offset reliance on subsidies and increase net return per acre.

Weed Control in Organic Apple Orchard
Producer: Gary Holwegner
Location: Sunnyside, Washington
Grant Award: $2,550
Summary: Weed control looks to be the most challenging problem in organic orchards. Not being allowed to use herbicides in organic orchards leaves few options other than hand hoeing which is very labor intensive. The aim of this study is to test the efficiency and effectiveness of a modified grape hoe for the control of weeds in the tree rows of an organic orchard.

Organic vs. Synthetic Fertilizer - Container Nursery Trials
Producer: Nils Sundquist
Location: Poulsbo, Washington
Grant Award: $4,575
Summary: The goal of this project is to test and demonstrate production of container-grown ornamental plants using regionally-generated organic fertilizers. A comparison study will be conducted of nitrate leaching and plant performance using organic and synthetic fertilizers in the containerized production of heather, hydragea, and ornamental grasses.

Improved Nitrogen Utilization and Herbicide Reduction Through Relay Intercropping
Producer: Gene Tinklenberg
Location: Lynden, Washington
Grant Award: $4,230
Summary: The project's plan is to seed Italian ryegrass in-between established corn rows during crop cultivation, applying herbicide only if needed. After seeding, grass germination occurs but growth is at a slow pace because of low light from the corn canopy until the corn is harvested. This multiple-cropping system provides minimal resource competition with the corn crop, and a weed- suppressing ground cover. After corn harvest, the grass grows rapidly and will be harvested the following spring prior to corn planting.

Wyoming

Tall Stature Grasses for Winter Grazing and Spring Calving
Producer: Matt Weber
Location: Baggs, Wyoming
Grant Award: $2,800
Summary: Standing-cured grasses of a "tall stature" type can project through the snow cover, providing late season cattle grazing with a minimum of supplemental water. Areas not well suited for intensive forage production can be converted to "cafeterias" of these tall grasses. This project will test the above theory by developing these "cafeterias" to see if they will perform under practical situations.

Guide to Progress Reports

By Key Topic

Western Region
Sustainable Agriculture Research and Education

IN THE PACKET

Progress reports of active research, education and professional development projects are organized in this packet as follows: Annual results of Sustainable Agriculture Research and Education, SARE, projects; and Agriculture in Concert with the Environment, ACE, projects, from smaller to larger project numbers. Final results of Sustainable Agriculture Research and Education, SARE, projects; Agriculture in Concert with the Environment, ACE, projects; and Professional Development Program projects, PDP, from smaller to larger project numbers. Farmer/Rancher Research projects are described in a booklet that is enclosed in the packet.

ORGANIZED BY KEY TOPIC

As a cross-reference, following are the SARE, ACE and Professional Development (PDP) projects organized by key topic or commodity, with corresponding project numbers. This should help you locate efforts of particular interest. A project may be appropriate for more than one category, however, each project is mentioned only once.

Ranching , Crop/Livestock, Dairy

- *Development of Sustainable Crop and Livestock Production Systems for Land in the Conservation Reserve Program (CRP)*, SARE #93-33 (Annual results)
- *Legume Cover Crops in Fallow as an Integrated Crop/Livestock Alternative in the Northern and Central Great Plains*, SARE #94-006 (Annual results)
- *Western Integrated Ranch/Farm Education*, SARE #94-034 (Annual results)
- *Range Monitoring in the Upper Stony Creek Watershed*, ACE #93-12 (Annual results)
- *Grazing Strategies for Sustainable Ranching Systems in Western Semi-Arid Zones*, SARE #92-31 (Final results)
- *Calibration of the Pre-sidedress Soil Nitrate Test to Improve Nitrogen Management of Dairy Farms*, ACE #93-11 (Final results)

Cover Cropping

- *Fall-planted Cover Crops in Western Washington: A Model for Sustainability Assessment*, SARE #94-008 (Annual results)

Vegetables: Corn, Broccoli, Lettuce, Tomatoes

- *Development and Demonstration of Integrated Vegetable Production Systems for the Maritime Pacific Northwest*, SARE #94-029 (Annual results)
- *Cover Crops Incorporated with Reduced Tillage on Semi-Permanent Beds: Impacts on Nitrate Leaching, Soil Fertility, Pests and Farm Profitability*, ACE #92-6 (Final results)
- *A Comparison of Conventional, Low Input or Organic Farming Systems: Soil Biology, Soil Chemistry, Soil Physics, Energy Utilization, Economics and Risk*, SARE #94-017 (Annual results). See also SARE #89-18 in *Western Region Annual Report, 1995*. Commodities include tomatoes, corn, beans and wheat.

Apples

- *Apple Production Without the Input of Neuroactive Insecticides*, SARE #94-023 (Annual results)
- *Comparative Performance and Farm-level Function of Conventional and Certified Organic Apple Production Systems in California*, ACE #92-9 (Final results)

Soil Microbiology

- *Role of Soil Microbial Biomass and Microbivorous Nematodes in Functioning of Sustainable Agriculture Systems*, ACE #92-7 (Final results). See also SARE #94-017.

Natural Resource Managment

- *Rotational Management of Wetlands and Cropland in the Tulelake Basin*, ACE #94-020 (Annual results)

Alternative Pest Control: Insects, Weeds, Disease

- *Influence of Cover Crop and Non-Crop Vegetation on Symphylan Density in Vegetable Production Systems in the Pacific Northwest*, ACE #94-033 (Annual results)
- *Soil Bacteria to Control Jointed Goatgrass in Integrated Cropping Systems*, ACE #91-05 (Final results)

Composting

- *Management of an On-farm Composting System*, ACE #94-010 (Annual results)

Professional Development for Agricultural Professionals

- *Multidisciplinary On-site Training in Sustainable Agriculture*, PDP #94-003 (Final results). Companion project to SARE #94-017. Commodities include tomatoes, corn, wheat and beans. Method: "hands-on" instruction. Audience: northern California.
- *Sustainable Agriculture Training Project: A Model of Collaborative Learning*, PDP #94-006 (Final results). Dryland production. Method: high use of producers to train professionals. Audience: Montana, Idaho, Eastern Washington and Utah.
- *Pacific Northwest Sustainable Agriculture Systems In-service Education Program*, PDP #94-008 (Final results). Varied topics, including local mini-grants. Audience: Oregon, Washington, Idaho and Alaska.
- *Extension Sustainable Agriculture Training in Eight Western States*, PDP #94-018 (Final results). Topics included grazing, hay production, pest control. Method: satellite teleconferencing and videos. Audience: Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah and Wyoming.
- *Training Agents in On-farm Implementation of Sustainable Management Systems for Tropical Agriculture in Hawaii and the Pacific Region*, PDP #94-014 (Final results). Method: intensive seminar training, then hands-on technology transfer in local areas. Audience: Pacific Islands.

Educational / Information-sharing

- *The Sustainable Farming Quarterly, A Regional Newsletter*, SARE #92-4 (Final results)
- *Western Region Community Supported Agriculture (CSA) Conference*, SARE #94-022 (Final results)
- *Permaculture Systems Pamphlet*, PDP #94-009 (Final results)

Resource-Limited Producers

- *Four-Corners Navajo Nation Sustainable Agriculture Demonstration Project*, SARE #93-34 (Annual results)

Quality of Life

- *Farming in the 21st Century: A Documentary Project*, SARE #94-54 (Annual results)

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Annual Results

SARE #93-33

Development of Sustainable Crop and Livestock Production Systems for Land in the Conservation Reserve Program (CRP)

Location:
Eastern New Mexico

Funding Period:
September, 1993 -

Grant Award:
$312,000

Project Investigator:
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Objectives

1. Develop livestock grazing systems for the predominate grass species growing on CRP land.
2. Identify dryland cropping systems for converting CRP grassland to sustainable crop production.
3. Compare the potential environmental impacts of the production systems evaluated in Objectives 1 and 2 with traditional crop and livestock production systems and current use of CRP land.
4. Identify and demonstrate techniques for improving and maintaining wildlife habitat on CRP and post-CRP lands.
5. Conduct an economic evaluation of alternative production systems including: (a) Whole farm cost and return analysis, (b) Short- and long-term profitability analysis, and (c) Risk analysis.
6. Determine the compatibility of potential production systems with existing production systems, established farmer goals and external production constraints.
7. Develop an information delivery component to: (a) Demonstrate various crop and livestock production systems and (b) Disseminate scientific, technological and economic information to agricultural producers.

Abstract of Results

The overall goal of the project is to develop economically viable crop and livestock production systems to extend the wildlife and environmental benefits of the Conservation Reserve Program (CRP) beyond the 10-year contract period while maintaining compatibility with existing production systems, established farmer goals and external production constraints.

CRP is a voluntary, long-term cropland retirement program whose primary goal is to reduce soil erosion on highly erodible cropland. By the end of 1996, more than 400,000 acres of land in eastern New Mexico are scheduled to come out of the CRP. This project is evaluating land use alternatives that may be available to farmers and ranchers when the program ends. This on-site CRP research/demonstration project was initiated in 1994.

Grazing research has shown that weeping lovegrass, the predominant grass species on CRP land in New Mexico, is suitable for cattle grazing. Five replicated grazing strategies were developed to evaluate different seasons and intensities of use. Gain per head from grazing weeping lovegrass in the spring and early summer was as high as 3 lbs. per day. The strategy of spring/fall grazing with fertilizer (38 lbs. N/ac) provided the greatest cumulative animal gain per acre (188 lbs.). Stocking densities on weeping lovegrass are as much as five times greater than native rangeland with comparable rates of gain.

Techniques for converting CRP land to sustainable crop production (grain sorghum and winter wheat) are being evaluated. In the hot, dry cropping seasons of 1994, the highest sorghum and wheat yields were obtained from conventional tillage techniques. The minimum and no-till systems failed to repress established perennial grasses. In the 1995, when grasses were controlled, there was a significant sorghum yield advantage from no-tillage. An in situ nitrogen mineralization study is determining how much nitrogen will become available for crop use by the decomposition of existing biomass.

The project is demonstrating simple and inexpensive techniques for developing wildlife habitat (food, shelter, and water) on grassland sites. Deciduous and evergreen shrubs have been successfully established (92% overall survival rate) by using a shallow V-trench and woven plastic mulch as a watershed and weed suppressant. A water catchment for wildlife use has been installed.

Crop and livestock cost and return estimate templates were constructed during 1995. The templates were developed using representative whole-farm data. This model will allow for the analysis of crop and livestock trial research results within a representative farm format. With further refinement, these templates will become a tool to assist individual producers in making their own post-CRP land use decisions.

Among the activities included in the educational component of the project are: an annual field day; presentations to various local groups and organizations; direct mailings to all CRP contract holders in New Mexico; presentations at regional and national meetings; and dissemination of project results through local and regional newspapers, magazines, radio and television.

Potential Contributions

Since few acres have come out of the CRP, there has been little adoption of the production systems explored in this project. As more acreage is removed from CRP in 1996 and thereafter, we expect to see increased adoption of these production systems. Prior to the initiation of the grazing component of the project, there was a great deal of skepticism about the viability of using weeping lovegrass for livestock grazing. This skepticism has resided since the grazing component of the project has shown weeping lovegrass can be successfully grazed. Many producers have expressed interest in the grazing trial and have indicated plans to set up similar production systems when their land comes out of CRP.

To this point, the tillage trials have been inconclusive. They have however shown that no matter what tillage system a producer chooses, it will be extremely difficult to obtain viable crop yields when removing land from the CRP without adequate lead time. In addition, it will be more difficult to eliminate perennial grasses with minimum and no-till cropping systems than with a conventional tillage system. The project has successfully demonstrated activities that can be used to enhance wildlife habitat in perennial grasslands. A third year's data will be necessary to validate results from the initial years of the project. This information will be integrated with economic and environmental analyses and will become the basis for operational recommendations.

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Annual Results

SARE #93-34

Four-Corners Navajo Nation Sustainable Agriculture Demonstration Project

Location:
Four Corners Region (of Arizona, Utah, New Mexico and Colorado), Navajo Nation

Funding Period:
September, 1993 -

Grant Award:
$300,000

Project Investigator:
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Farmers & Other Cooperators:
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Joe & Carol Benally, Pinon, AZ
Raymond & Lena Benally, Jeddito, AZ
Sharon Begay & Terrell Piechowski, Ganado, AZ
Alta Begay, Ganado, AZ
Leo, Sarah and Rebecca Natani, Table Mesa, NM
Ruth Watson, Shonto, AZ
Lorena Noelson, Shonto, AZ
Rozita Jake, Navajo Wool Marketing Industry, Shiprock, NM
Allan Blacksheep, Ganado Unified School District, AZ
Milton Bluehouse, The Navajo Nation, Ganado, AZ
Carlos Manzanares, The Navajo Way, non-profit ag cooperative, Burnside, AZ
Herbert Holgate, Navajo Nation Dept. of Agriculture, NM

Objectives

1. Develop and sustain improved socio-economic conditions for Navajo agro-pastoralists, while maintaining cultural integrity through the preservation of the traditional 'Navajo Lifeway'.
2. Develop integrated systems to maximize output from Navajo agro-pastoral production practices, while minimizing negative environmental impacts, which include soil, plant, energy, waste management and water quality considerations.
3. Develop a trans-disciplinary, whole-farm systems model for sustainable Navajo rural economic development. The process would incorporate a two-way cross-cultural transfer of agro-pastoral technologies.
4. Provide on-site mentoring by a trained Navajo, develop entrepreneurial skills, and cultivate leadership proficiency among the Navajo cooperator participants.
5. Establish a Four-Corners Sustainable Agriculture and Natural Resources Advisory Council, made up of participants representing elected officials, federal and state government agencies, land-grant universities, private enterprise and other appropriate organizations representing the states of Arizona, Utah, New Mexico and Colorado ,and the numerous Native American reservations that encompass the Four-Corners region.

Abstract of Results

The integrated and diverse team of scientists developed their annual work plans from the assessments and priorities that each family determined during the fall of 1994. Generally the project implementation plans embraced most of their desires as they related to sustainable agriculture and pastoralism in the Navajo cultural context. However, most of the barriers established by the cooperator families are too difficult to overcome in one year. Many of those barriers are institutional, both political and social. Yet a close working relationship between the scientists and each of the Navajo cooperators became demonstrably important. The overall emphasis of the project is to help sustain an agro-pastoral lifestyle by demonstrated practices to help enhance the quality of life of each cooperator, and spread the 'word' by model Navajo practitioners. Through the practices and visible accomplishments of the Navajo cooperators, the project team is getting requests from additional Navajo families who would like to join the cooperator base.

All families began a planning process with which to manage their sheep and goat flocks. Enhanced lifecycle nutritional feeding was initiated during the winter months, coupled with ad libitum salt/mineral mixes. One cooperator brought the entire Chapter's (area comparable to a county) sheep and goat population from their customary use area to high mountain summer grazing off the Reservation (which was once the traditional Navajo land claim and Northern sacred peak, Dibe Ni'tsaa [Big Sheep] in Colorado) at the Colorado State University-San Juan Basin Research Center (SJBRC) near Hesperus. Two field-days/workshops for the Navajo families and others of the region were held at the SJBRC with many Navajos in attendance. Grazing habits of goats vs. sheep vs. llamas were evaluated. Guard llamas were placed with the demonstration flock, numbering over 950 head of ewes, lambs, does, and kids. No losses during this season were attributed to predation, while a neighboring rancher, using traditional range sheep operation, reportedly lost lambs due to predation by bears. Bears were an obvious problem this year in LaPlata

County due to the absence of typical summer wild berries. Observations and livestock behavior demonstrated that goats, especially Spanish goats, preferred Oak brush over other woody and non-woody species available. It was also observed that llamas were an effective biological control against thistle in riparian areas.

Home site analyses were performed at each of the Navajo cooperator families. Garden and horticultural plant materials were re-introduced as per requests of each cooperator family. Specific developments and demonstration sites were enhanced by enlarged gardens and utilitarian types of plants near established hogans. A complete conceptual landscape plan was developed for one anticipated new hogan/home to be built in the Jeddito area. The nuclear family and extended family clan/outfit were brought into the planning stages of each of the botanical projects with the cooperating families. Functional agricultural plant materials were utilized in all cases. Plants that can be utilized for wool dyeing, basketry, foodstuffs, medicinal and ceremonial purposes are of primary concern to the team.

An economic analysis has been conducted with three of the four Navajo cooperator families. All of the families desire to become more self-sufficient and generate enough revenue to cover the costs of traditional yet sustainable agro-pastoral practices. One family initiated a value-added wool processing enterprise to their existing operation. A mail order catalog was created, describing various types of raw fleeces, carded roving, traditional Navajo foods, yarns, handmade vertical looms, vegetal wool dye kits, tanned pelts and custom Navajo rugs. Another cooperator family initiated a therapeutic bear sewing project employing six Navajo women on the cooperator's home site. A cooperating family's daughter, who is a recent high school graduate, has been receiving business training from the project team to oversee this business venture. Surplus computers and printers were acquired for each of the Navajo cooperator families, and a weekend computer training workshop was provided. New value-added products and alternative marketing avenues are being investigated. One family in 1996 will be exploring the possible development of a hogan bed and breakfast. Other families are considering alternative methods to market their value-added products both on and off the Reservation.

Site Information

Rangelands traditionally used by most cooperators are dominated by woody plants (sagebrush, juniper, pinon, greasewood, rabbit brush). The climate of the area is characterized by cold winters and hot summers. Precipitation ranges from 6 inches near Jeddito Wash to 20 inches or more on the Chuska Mountains and Defiance Plateau, and is bi-modal with late summer and winter period peaks. The average growing season ranges from 140 to 160 or more days in length, depending on elevation. Elevations range from 5,500 feet near Jeddito Wash to 8,500 feet on the Chuska Mountains.

Potential Contributions

- The actual development and provision of value-added enterprises to enhance and supplement personal and family financial resources.
- A sense of pride and self-empowerment of becoming exemplary family and farm models by Navajo cooperator families in their respective communities.
- The movement of families towards emotional solidarity and harmony with traditional culture through the implementation of integrated agro-pastoral practices and involvement.
- A strong bond of trust with Anglos and a positive attitude towards the universities and programs they represent.
- Increased responsibility toward land and livestock stewardship.
- Personal empowerment and self-esteem, with the ability to articulate with Navajo Chapter and Tribal officials the importance of agricultural issues.
- An overall change in attitude and improved outlook on the quality of their (Navajo cooperator) lives.

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Annual Results

SARE #94-006

Legume Cover Crops in Fallow as an Integrated Crop/Livestock Alternative in the Northern and Central Great Plains

Location:
Wyoming, Montana and Colorado

Funding Period:
July, 1994 -

Grant Award:
$160,000

Project Investigator:
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Objectives

1. Determine the feasibility of utilizing peas as the forage component to integrate livestock into the wheat/summer fallow cropping system. (Wyoming)
2. Determine the efficiencies of water-use, biomass and N-fixation when incorporating peas into the wheat/corn/summer fallow cropping system. (Colorado)
3. Determine adaptation, water-use, biomass and soil nitrogen contribution of late-summer seeded legumes in the dryland spring wheat or barley/summer fallow rotations. (Montana)
4. Demonstrate the effectiveness of incorporating legumes into the agroecosystem through on-farm demonstrations, workshops, field tours and mass media for producers/extension/research and Natural Resource Conservation Services personnel.

Abstract of Results

In Wyoming, there have been two years of utilizing peas for lamb grazing in the wheat/summer fallow cropping system. Austrian winter peas (AWP) have provided excellent forage for lamb grazing in this cropping system. Lambs were grazed on spring planted peas in 1994 and fall planted for 1995. Whole plant crude protein averaged 20.4 percent for the two years and was equal to high quality alfalfa. Pea digestible dry matter averaged approximately 5 percent higher than prime quality alfalfa hay. In 1995, total gain per acre for the five-week period equaled 190 lbs. At $0.75/lb. this was a gross income of $142.50 per acre. In addition, 1,080 lbs. per acre of residual forage was left as green manure after grazing. No bloating problems have been observed in the 60 lambs grazed on peas over the two years. Lamb gain rates for 1994 are not reported because of a faulty scale. The 1994 grazed pea crop reduced the yield of the following wheat crop about 19 percent, when compared to conventional fallow. The grazed treatment had a wheat seed protein content about one percentage point higher than the fallow. This agrees with our previous research in which pea green manure has increased the quality of the following winter wheat crop.

Our initial efforts have focused on getting the wheat-corn-fallow rotations started at both the Sterling and Stratton, Colorado sites. All phases of the rotation are present every year to allow data interpretation over a shorter period of time. After corn harvest we are experimenting with the insertion of peas into the fallow period to attempt to get both a cover and nitrogen (N) contribution. Two scenarios are being researched: 1. AWP planted no-till in the corn stalks in the fall after corn harvest, and 2. field peas planted no-till into the corn stalks in the early spring following corn harvest. In both cases the peas are allowed to grow until July. At this point we are experimenting with complete and partial removal of the peas as a forage for livestock. AWP forage yields were 3,500 lbs. per acre and spring pea forage yields were 1,370 lbs. per acre at Stratton. Plant populations were so sporadic at the Sterling site that no meaningful yields could be measured. Peas were harvested in July, 1995 and by wheat planting in September the soil water accumulated was essentially the same in treatments that had peas versus those that had no peas. Farmer interest has been moderate to high, especially at the Stratton site.

The late season seeding of annual legumes into fallow was attempted at only three locations in 1994 due to funding delays and dry weather in July. Acceptable stands were achieved only in Moccasin, Montana. However, in 1995, good stands were achieved at all locations. Spring wheat will be seeded at all locations

in 1996. It is estimated that Montana dryland farmers planted about 80,000 acres of peas, lentils, medics and other annual legumes in 1995. Public tours of research with legumes were conducted in 1995 in all 3 states.

Site Information

In Wyoming annual precipitation in 1994 was 20 percent below normal, and 28 percent above normal in 1995. In 1995, above normal precipitation in April and May produced a record winter wheat crop, but the cool temperatures delayed AWP growth. It then became dryer than normal in July and August. In Colorado the climatic conditions in 1995 were dryer than the long-term means, especially in July and August. This prevented maximum water storage after pea harvest and should have caused the greatest problems for wheat plant establishment in fall 1995. However, to date wheat plant populations are similar regardless of pea treatment and are excellent at both sites. Our plots are on nearly level benches and gently rolling hills in northern Great Plains and intermountain valleys of Montana. Average annual precipitation varies from 12 to 17 inches on these dryland soils which are mostly Mollisols and Entisols such as Typic Argiborolls, Typic Haploborolls and Ustertic Torriorthents. Frost free seasons range from 90 to 120 days.

Potential Contributions

In Montana, seeding legumes at mid-season into summer fallow can increase precipitation use efficiency by 40 percent or more, provide up to one Animal Unit Month per acre of fall grazing, reduce or prevent saline seep formation on more than 100,000 acres and reduce nitrogen fertilizer costs by $10 to $15 per acre.

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Annual Results

SARE #94-008

Fall-Planted Cover Crops in Western Washington: A Model for Sustainability Assessment

Location:
Skagitt Valley, Western Washington

Funding Period:
July, 1994 -

Grant Award:
$80,000

Project Investigator:
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Farmer Cooperators:
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David Hughes, Mount Vernon
Bob Rose, Mount Vernon
Richard Smith, Mount Vernon
Gail Thulen, La Conner

Objectives

1. Determine the biological and socio-economic value of nitrogen conservation and wildlife habitat enhancement.
2. Encourage adoption of cover crop practices by farmers through increased farmer-to-farmer responsibility for education and applied research.
3. Increase the understanding and appreciation of the value of fall-planted cover crops among members of the non-farm public.
4. Develop and test new mechanisms for strengthening partnerships between the agricultural community and environmental interest groups.

Abstract of Results

Cooperators from the Skagit Valley were recruited to test the value of nitrogen recovered from fall-planted cover crops which were incorporated in the spring. The on-farm experiment was based on research conducted at the Washington State University, WSU, Mount Vernon Research Unit, which showed that cover crops planted in early September could accumulate up to 150 pounds of nitrogen per acre. This research also indicated that when cover crops were incorporated into the soil in the spring, nitrogen concentrations in the soil increased in May and June. Cash crops used in the on-farm experiment were cucumbers and potatoes.

A graduate student from Western Washington University will be working with volunteers and WSU extension personnel during the winter of 1996 to monitor use of cover cropped fields by swans, snowgeese and waterfowl. The study, currently in the design phase, may include other measurements, such as use of specific areas by bird watchers.

An educational video, primarily for agricultural audiences, is being produced to educate and motivate crop producers to add fall-planted cover crops to their management systems. The video will also be used to educate selected non-farm audiences about farmers' environmental stewardship efforts, and the value of cover cropped fields to wildlife. Experiences and attitudes of farmers and environmentally-concerned citizens about fall-planted cover crops are an integral part of this video. To this end, approximately thirty preliminary interviews have been conducted to gather insight about farmer and non-farmer attitudes, experiences and perceptions concerning agricultural stewardship. From this pool, interviewees will be selected to participate in taped interviews for the video.

Two other educational videos are also being produced. One, for home gardeners, discusses gardening and landscaping practices that protect water quality. The other, for small acreage farmers with livestock, discusses best management practices related to stream bank, manure and mud management. Production teams have been organized for each video, and each group has produced a basic script. Approximately twelve hours of video footage has been accumulated.

In order to promote the public's understanding of the role of agriculture in environmental stewardship, the Skagit Valley Tulip Festival brochure contained a section titled "Cooperative Efforts By Farmers To Enhance The Environment." Over 300,000 copies of the brochure were distributed to festival attendees from throughout the Pacific Northwest.

A fifteen-member focus group, involved in previous research and education on nitrate leaching, helped develop the objectives of this grant and the on-farm experiment design. In March, 1995, the group shifted many of its activities to topic-based sub-groups, these to be supported by annual or semi-annual meetings of the large group. An On-Farm Research Sub-Group, which includes the on-farm research cooperators, determined experiment details.

An Ag/Environment Sub-Group was also formed. This group is exploring ways to develop and strengthen partnerships between the agricultural community, consumers and environmental interest groups in the Skagit Valley. The group is made up of farmers, representatives from environmental and farmland preservation organizations, and university research and extension personnel. The group expressed a need for more insight into the attitudes and perceptions that Skagit Valley farm and non-farm communities have about each other. To that end, approximately 15 representatives from each group have been informally interviewed.

Economic Analysis

In order to determine the cost to farmers of establishing and managing fall-planted cover crops, farmers monitored the cost of seed, and the cost of their time and equipment for ground preparation and planting, and for incorporating cover crops in the spring. The cost of establishing cover crops in the Skagit Valley averages about $40.00 per acre. Five farmers participated in the study. Each planted three cover crops that are frequently used in this area - cereal rye, white oats and winter wheat.

Potential Contributions

Investigators will gain a better understanding of factors to consider when designing on-farm research. All project cooperators will gain increased understanding about their own and other peoples' attitudes and knowledge of agricultural stewardship. Some farmers have reduced nitrogen fertilizer rates for potatoes, resulting in reduced risk of negative environmental impacts from excess nitrogen fertilizer and reduced production costs.

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Annual Results

SARE #94-017

A Comparison of Conventional, Low Input or Organic Farming Systems: Soil Biology, Soil Chemistry, Soil Physics, Energy Utilization, Economics and Risk

(Continuation of SARE #89-18)

Location:
Sacramento Valley, California

Funding Period:
July, 1994 -

Grant Award:
$186,666

Project Investigator:
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Frank Zalom, Entomology
Howard Ferris, Nematology
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Ariena Van Bruggen, Plant Pathology
Kate Scow, Microbiology
Carol Shennan, Robert Miller, Soil Fertility & Plant Nutrition
Tom Lanini, Weed Management
Jeff Mitchell, Water Relations

Farmer Cooperators:
Jim Durst, Esparto
Bruce Rominger, Winters
Ed Sills, Pleasant Grove
Tony Turkovich, Winters

Objectives

1. Compare four farming systems, with differing levels of dependence on external resources over a twelve year period, with respect to: abundance and diversity of weed, pathogen, arthropod and nematode populations; changes in soil biology, physics, chemistry, and water relations; crop growth, yield and quality as influenced by different pest management, agronomic and rotational schemes; and, economic viability.
2. Evaluate existing and/or novel sustainable and organic farming tactics.
3. Distribute and facilitate adoption of information generated by this project to all interested parties as it becomes available.

Abstract of Results

Abnormally high rainfall in the winter of 1994-95 had a significant impact on production across systems and crops, and yields were somewhat lower than usual for most crops and systems. Low-input corn and tomatoes were among the highest yielding crops for 1995, showing that this system is extremely competitive with the four-year conventional rotation. Winter wheat yields in the two conventional systems were decreased significantly by the heavy winter rains, while the oat/vetch yields in the low input and organic systems were more than double the yields of previous years. Nitrogen deficiency continued to be a problem for the organic corn and tomatoes, resulting in decreased yields. Organic and low input bean yields were severely reduced by heavy weed pressure, possibly resulting in economic losses. Extensive soil work conducted in the corn plots showed that surface crusting may be responsible for decreased water penetration and lower nitrogen utilization efficiency in the conventional corn. Companion area results indicated that many grass/legume mixtures could be grown under reduced till management with insignificant yield reductions and positive economic gains.

Site Information

The research plots are located on the Agronomy Farm at UC Davis, Yolo County. Prior to the initiation of the experiment, the acreage had been managed with conventional practices including the use of synthetic pesticides and fertilizers. Because different sections were cropped to alfalfa, vetch and beans, replicates were blocked. The experiment is conducted on Yolo silt loam, a medium to heavy soil. The climate is Mediterranean, with average summer day temperatures of 90 degrees. The majority of the rainfall is received between December and March, with a yearly average of 18 inches. All plots are furrow irrigated with water from Lake Berryessa, about 30 miles east. The plots are 1/3 of an acre to allow for use of large scale farm machinery for all operations.

Economic Analysis

All of the systems were profitable overall. The two conventional systems showed virtually the same net return at about $280 per acre. The low input system had higher gross returns and higher costs than the conventional systems resulting in a net of about $250 per acre. The organic system had the lowest gross

returns and the highest costs and consequently the lowest profit when conventional prices were used. The organic price premiums were enough to offset the lower organic yields to give the premium priced organic system the highest gross returns but not enough to offset the higher costs. The net return for the organic system with premium prices was $228 per acre, while the organic system without premium prices had a net return of only $10 per acre.

Potential Contributions

Cover Crop Management: Specific data has been collected for production of cover crops for green manure, green chop, and seed harvest. The two winter companion area experiments have shown a number of species and species mixtures to be successful in this bioregion. Oat/vetch, barley/vetch and faba/pea were all economically viable and showed only slight yield reductions under reduced tillage. If implemented, reduced tillage management could increase energy savings and increase economic returns. Various vetch species alone and in mixtures were also tested for biomass, N production potential and weed suppression. In both 1993 and 1994 lana vetch had higher N production and less weeds than purple vetch and faba/vetch and lana/cowpea mixtures. Because the 1993 and 1994 winters were so climatically different, these results suggest that lana vetch is well adapted to a wide range of conditions. Results from these cover crop studies could be very useful and practical for growers needing information about specific cover crops under a various climatic and management conditions.

Low Input Management: The low input system is emerging as a very strong alternative to conventionally-managed systems. Yields are consistently competitive in the corn and tomatoes. The success of this system clearly shows that a combination of cover crop and mineral supplement not only provides sufficient N, but that the cover crop has tangible values beyond fertilizer N replacement. The economic success of the low input corn also makes it a strong contender for real world application. Three years of results indicate that mineral fertilizer in corn can be reduced by 50 percent when adequate nitrogen is supplied from a cover crop.

Benefits of Tissue Tests: Tissue tests at key growth stages in corn have been very useful in identifying N deficiency in the organic corn system and alerting us to a production and N efficiency problem in the conventional system. These tests are very easy to do and could be used in growers' fields to more effectively monitor N status of corn crops.

Disease Suppression: Increased disease pressure in the two-year rotation may continue over the course of the experiment, which suggests that the four-year rotations may have long-term disease suppression. The organic and low input systems may eventually show even further disease suppression from cover crops and manure relative to the conventional four-year system. Extensive work has begun in the last year to assess floral and fauna pathogen suppressiveness of the different soils.

Although most traditional agronomic experiments are much shorter than this project, we believe that seven years is a very short time for certain differences to emerge. It has taken seven years to see negative impacts of the two-year rotation as well as the positive effects of the soil tilth in the low input and organic system. Long-term positive benefits such as substantial increases in organic matter contributing to improved soil aggregation or water infiltration are becoming clearer with each season and warrant further exploration. We expect that new benefits will be continually identified as time passes.

Farmer Adoption

Changes observed and reported through verbal communication include greater interest in cover crops, legumes and crop rotations; increased organic acreage in field crops; increased monitoring by growers of water use/efficiency, pest thresholds and soil and crop nitrogen requirements; and heightened interest in a more holistic view of soil health. Agricultural equipment dealers have also begun demonstrating more of an interest in specialized equipment, specifically for tillage and non-chemical weed management. As the project has matured, there is widespread consensus that we have been able to demonstrate to the tomato industry that organic production is biologically possible and economically viable at premium market prices.

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Annual Results

SARE #94-023

Apple Production Without the Input of Neuroactive Insecticides

Location:
Oregon and Washington

Funding Period:
July, 1994 -

Grant Award:
$268,000

Project Investigator:
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Chuck Peters, Wapato
Dave Garretson, Yakima
Ken Bailey, The Dalles, OR
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Objectives

1. Determine the densities of arthropod pests and associated natural enemies and the level of crop loss due to arthropods in apple orchards using control tactics that do NOT include the use of broad-spectrum (neuroactive) insecticides.
2. Determine the impact of augmentative and/or inoculative releases of selected parasites on the control of codling moth and leafrollers and their compatibility with non-broad-spectrum insecticides used for pest control.
3. Determine the economics of producing fruit without neuroactive insecticides and the potential for specialty markets or any value added to apples produced in this way.
4. Compare the level of neuroactive insecticides on fruit and in the soil in orchards using these products and those in the project not using them.
5. Determine the change in soil fauna composition through time in orchards using neuroactive insecticides and those not using them.
6. Demonstrate the educate members of the apple industry via field-days, popular journal or trade journal articles and presentations at grower meetings on the advantages and disadvantages of producing apples without the input of broad-spectrum insecticides.

Abstract of Results

The purpose of this study is to directly compare the ecology and economics of different management approaches for Delicious apple production: one system managed using no broad-spectrum insecticides, the other managed conventionally. Six orchards were selected for the study, five in Washington (Bridgeport, Chelan, Orondo, Wapato and Yakima) and one in Oregon (The Dalles). Each orchard was divided into a ten-acre conventional block and a ten-acre non-insecticide block. Pheromones were used as the primary control for codling moth in the non-insecticide orchards. This treatment alone was as effective as conventional azinphosmethyl sprays at two sites.

High codling moth population densities at the other four sites necessitated supplementing the pheromone treatment with oil sprays and parasitoid releases. This combination provided good control of the moth in two orchards, but greater than 3 percent pest fruit injury was recorded at harvest in the other two non-insecticide orchards. Insufficient moth control in the non-insecticide orchards was primarily associated with the inability of selective materials to control border infestations of this pest.

Leafroller populations were well controlled in all of the conventional orchards but reached damaging levels in four of six orchards not treated with insecticide. Detecting the build-up of leafroller populations in time to control them with selective tactics was difficult. The development of effective methods for sampling leafroller populations will be a major research component of this project over the next two years. Other secondary pests were generally at low levels in the non-insecticide orchards. Natural enemies contributed to the suppression of many of these potential pests. Three species — white apple leafhopper, green apple aphid and tentiform leafminer — reached population densities that required intervention with insecticides in at least one of the conventional orchards. Detailed management input records have been kept for each of the orchards being tested; they will be used to compare the economic risks and benefits of these two management programs.

Dissemination of Findings

Project findings are being shared through conferences, workshops, field days, trade journal articles, and presentations at grower meetings. Early in the year, participating growers, crop consultants, and research and extension cooperators met to review the objectives, discuss the procedures and plan the seasons activities. In subsequent years these planning meetings will be open to the public for information and comments. Three of the research sites were visited by about 25 growers and consultants during a field day held in July, 1996. The findings of our project were presented to about 3,000 growers in a poster display at the annual meeting of the Washington State Horticultural Association in early December. A workshop was also held in January, 1997, focusing on ecological aspects of reducing insecticide inputs. We are currently outlining extension bulletins on 1) the use of pheromones (mating disruption) for codling moth control and 2) sampling protocols for orchard pests and their natural enemies.

Farmer Adoption

The use of pheromone, bacterial insecticides and other selective tactics for control of apple pests is becoming more widespread in Washington as the incidence of pests that have developed resistance to conventional insecticides increases and the value of preserving natural enemies becomes more widely recognized. We predict that pheromone will be applied as the primary control for codling moth on 25,000 acres of apples in Washington in 1996. A major impediment to greater adoption of this soft approach to codling moth control is the concern that non-target pests will increase in abundance in the absence of broad-spectrum insecticides. Our project has generated interest in the tree fruit industry as a primary source of information regarding new techniques and strategies for managing these secondary pests in apple.

Operational Recommendations

We make the following recommendations with respect to codling moth control with pheromones: 1) apply a minimum of 400 dispensers per acre, 2) place them within two feet of the top of the tree canopy, 3) supplement with other selective controls on the borders, 4) monitor with high load pheromone traps placed high in the tree canopy and at a density of at least one trap per 2.5 acres, and 5) inspect borders biweekly for signs of infestation. In the first year of not using broad-spectrum insecticides, we suggest applying at least two applications of *Bacillus thuringiensis* (Bt) for leafroller control. We recommend regular monitoring of other non-target arthropods since many of the potential pests will be held in check by their natural enemies.

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Annual Results

SARE #94-034

Western Integrated Ranch/Farm Education

Location:
Wyoming, Montana and Utah

Funding Period:
July, 1994 -

Grant Award:
$90,000

Project Investigator:
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Objectives

1. Teach ranchers/farmers a process of integrated management — Western Integrated Ranch/Farm Education, WIRE — in three states: Wyoming, Montana, and Utah.
2. Develop in-depth follow up training in specific resource areas, to meet needs identified by program participants.
3. Evaluate the program in terms of adoption of management concepts and resource sustainability following implementation of the WIRE process by selected cooperators.

Abstract of Results

The primary accomplishments of this project to date have been focused on the first objective listed above. Specific activities directed toward the accomplishment of this objective are outlined below.

Although grant funds were made available in 1995, regional WIRE activities actually began a year before this. These activities included: teams of interested individuals from Utah, Montana, and Idaho extension attending a Wyoming producer course; discussions of methods of offering the WIRE course in each state; and preliminary discussions of methods of funding a regional WIRE effort.

A multi-state coordinating committee was formed to provide leadership to this project for the entire region. This coordinating committee is composed of three representatives from each state. These, representatives include the state team coordinator(s), another state team instructor, and a producer from each state. In addition, the principal investigator also to serves on the committee.

The first regional coordinating committee was held in Thermopolis, Wyoming in March, 1995. Committee function and governance was discussed, as well as how the Wyoming WIRE program would be implemented across the region. In addition, the committee voted to include the state of Idaho on the committee, as they are attempting to institute the WIRE program in that state as well.

Sub-committees were formed for investigating changes and/or updates to the Wyoming WIRE materials to better fit the regional program. In addition, the committee discussed the development of new program materials for use in regional program offerings.

In early 1995, three members of the Wyoming WIRE teaching team traveled to sites in Logan, Utah and Sheridan, Wyoming to provide training to state teams from Utah and Montana, respectively. At these training sessions, teaching materials were supplied, course outlines were discussed, and teams were assisted in organizing themselves in preparation for offering the course in the coming year. After receiving training, state teams began various activities to begin building the WIRE program in their states.

The Montana team conducted informational meetings with the following audiences: the International Beef Symposium, Montana State University (MSU) Animal & Range Departmental Field Days, Montana Stockgrowers Convention, Montana Woolgrowers Convention, Montana Association of Conservation Districts, the Montana State Departments Young Ag Couples program, and at least five Montana county extension producer meetings in southwest Montana. The total number of people reached is estimated to

be 670. In addition, the Montana WIRE team held several organization/planning meetings and trained an additional seven MSU county agents who are now part of the Montana WIRE team. This newly formed Montana WIRE team offered the course in two locations this fall to a total of 52 producers representing 23 ranches.

The Utah WIRE team met periodically throughout the year in an effort to develop a new case study operation and format for the course that fit Utah ranch situations. The new case study includes irrigated crop production and public land grazing allotments, both of which are common in Utah. A trial in-service offering of the Utah WIRE course was made in October, in preparation for presentation to producers in January, 1996. The Utah team also marketed the program to the Utah Cattlemens Association and the Utah Wool Growers Association conventions.

The Wyoming team offered their seventh WIRE course in May. This provided an opportunity to bring in a film crew and produce video and audio tape for advertising the program around the Western region. This tape was distributed to all state teams by September. The Wyoming team used the video tape in conjunction with a poster display to advertise the program at the Wyoming state fair, Wyoming Stock Growers, and Wyoming Wool Growers meetings. The poster was also displayed at a Wyoming Public Lands program. In addition, television time was purchased on three TV stations to run the WIRE ad over a period of two weeks. This coupled with a distribution of an audio tape to Wyoming radio stations, helped to raise producer awareness of the program.

The project coordinator took the lead in developing a WIRE workbook for use with producers taking WIRE courses. It is designed to assist producers in working through the first three steps of the WIRE processestablish strategic goals, inventory resources, and explore possible enterprises. This workbook along with other WIRE course materials were supplied to state teams for offering producer courses. These materials included the WIRE reference book, course materials and case history book, financial calculators, custom clipboards, and frames for certificates of completion. In addition to these activities, the Wyoming team also continued to offer the WIRE follow up programs in Financial Management and Marketing and Risk Management. The total number of participants in Wyoming WIRE programs was 25 in 1995.

Producer Involvement

A total of 77 producers participated in WIRE workshops during this reporting period, and an estimated 1,470 ranchers and others learned about the program and its goals through outreach efforts aimed at producer and commodity organizations, and other publicity efforts.

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Annual Results

SARE #94-29

Development and Demonstration of Integrated Vegetable Production Systems for the Maritime Pacific Northwest

Location:
Oregon

Funding Period:
July, 1994 -

Grant Award:
$80,000

Project Investigator:
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Carl Hendricks, Scio
Peter Kenagy, Albany
Dale Lucht, Molalla
Larry and Ron Pearmine, Gervais

Objectives

1. Develop, evaluate and demonstrate integrated vegetable production systems for the maritime Pacific Northwest which improve farm profitability, protect water quality, and enhance long-term soil productivity.
   - Evaluate the role of fall-planted cover crop mixtures of cereal grains and legumes to capture soil nitrogen and reduce leaching, and contribute biologically-fixed nitrogen to the following vegetable crop.
   - To evaluate cover crop interseeding strategies into vegetable crops to enhance biological diversity within the cropping system, accelerate cover crop establishment, and eliminate fall tillage requirements.
   - Develop and evaluate conservation tillage systems using cover crops for vegetable production.
2. Improve methodologies for enhancing farmer and agribusiness participation in the design and implementation of on-farm research and demonstration projects for integrated, sustainable agriculture.
3. Conduct a multi-faceted educational program which accelerates information transfer among producers, extension specialists and agents, agribusiness representatives, governmental agency personnel, and the university research community.

Abstract of Results

The major purpose of this project is to develop and evaluate integrated vegetable production systems for the Pacific Northwest which enhance environmental and economic viability. Enhancing farmer participation in research planning and implementation is also a major goal. Using both on-station and collaborative, on-farm research, this project has focused on utilizing winter annual cover crops, relay interplanting and minimum tillage practices to: (1) reduce ground water contamination from nitrate leaching, (2) reduce surface water contamination from soil erosion and transport of agricultural chemicals, (3) reduce nitrogen fertilizer input requirements through the use of legume cover crops, (4) reduce tillage costs, energy requirements, and destructive effects on soil structure, (5) enhance integrated weed management practices and reduce herbicide input requirements, and (6) enhance habitat for naturally-occurring biological control agents within annual agroecosystems.

In 1995, ten collaborative, on-farm research trials and five on-station experiments were used to address project goals. Replicated, on-farm research trials evaluated options for cereal/legume cover crop mixtures which would provide adequate nitrogen capture and fixation, but not produce excessive quantities of biomass in the spring. In several of these trials, as well as on-station research, the nitrogen contribution of cover crops to the succeeding vegetable crop yield was examined. Participating vegetable growers utilized information from these trials to increase their confidence in selecting suitable cover crop mixtures and in managing cover crops. Growers also provided leadership for field days, expanding the learning of these trials to a larger farmer audience.

Significant progress was made in the development of conservation tillage systems for vegetable crops. A strip-tillage system for sweet corn production was developed with a collaborating farmer. This system, used in an 80-acre on-farm trial, produced equivalent corn yields to conventional tillage, yet reduced herbicide inputs by 67 percent and reduced tillage operations by 500-700 percent. This system will be

expanded to five farms in 1996. A similar system for strip-tillage squash production performed comparably in on-station trials, and this system will be taken to three on-farm demonstration trials in 1996.

Relay interplanting was explored as a strategy to improve cover crop establishment in broccoli, as well as to enhance habitat for naturally-occurring predators of insect pests. In relay-interplanted trials, population abundance of predacious carabid beetles was more than doubled compared to clean-cultivated treatments.

Weed suppression by cover crops was also examined. Virtually all winter annual cover crops examined significantly reduced weed populations, and two particular cereal cultivars (cereal rye and 'Monida' oat) exhibited weed suppressiveness in the succeeding vegetable crop.

Participation by growers in the on-farm research process was increased dramatically in this project. Growers participated in meetings to determine the goals of the research and the appropriate field plot design, and actively participated in establishing and evaluating the on-farm trials.

Economic Analysis

An economic evaluation of the costs of cover crop production, based on individual grower records, has shown the variable costs to range from $35-50/acre, including tillage operations. Efforts to determine nitrogen contribution by cover crops has been targeted at recouping the cost of 80-100 lbs. of N fertilizer, worth about $25-35 per acre. The primary motivating factors for growing cover crops, according to collaborating growers, is to improve soil quality and help reduce nitrate leaching. The economic value of these kinds of qualitative benefits has not yet been estimated. One of the major risks in growing cover crops is the potential for lost revenue if the cover crop delays the vegetable planting schedule. Soil typically remains wetter under cover crops in the spring compared to bare soil. Incorporating cover crops under wet soil conditions can create serious soil compaction problems. These problems are particularly acute with the typically wet springs of western Oregon and a planting schedule dictated by the vegetable processing industry. The current work on ridge-till and strip-tillage systems in this project is focused specifically at increasing the flexibility of soil preparation and planting under excessively wet conditions. Economic and energetic analysis of these reduced tillage systems will be conducted.

Farmer Adoption

All of the ten growers involved with our 1995 on-farm research program are increasing the amount of acreage planted to winter cover crops (an estimated increase of 500 acres compared to 1994). One grower will be growing 150 acres of strip-tillage corn in 1996, two other growers will be growing 15 acres of strip-tillage broccoli.

Operational Recommendations

We recommend mixtures of cereal crops and legumes, preferably planted from September 15 - October 21. Maximum N contribution is obtained by planting a pure stand of legume. Spring cover crop management should be based on projected vegetable crop planting dates, with total above-ground cover crop dry matter biomass managed not to exceed three tons per acre. Glyphosate herbicide or mowing can be used. Strip-tillage systems for sweet corn use a flailed cover crop, strip-tillage of 6" wide strips on 30" centers, banded 10" herbicide strips over the row, possible glyphosate application to kill cover crop re-growth following mowing (if needed), followed by one pass with a no-till cultivator approx. three to four weeks after corn planting.

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Annual Results

SARE #94-54

Farming in the 21st Century: A Documentay Project

Funding Period:
July, 1994 -

Grant Award:
$27,000

Project Investigator:
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Major Participants:
David Schlegel, former Western SARE coordinator
Kristen Kelleher, Western SARE communications specialist

Objectives

1. Document the impact of sustainable agriculture on farm families and communities that can be used to enhance biological research and assist in the research of social scientists.
2. Aid in major image-building for the family farm system of agriculture and provide an opportunity for all members of a farm family unit and farmer cooperators to have a voice in the rural social process.
3. Provide a multi-component project which will identify specific local, state and regional agricultural issues and determine particular educational needs, yet also create a vehicle for broad dissemination.
4. Utilize regional farmer cooperators, community leaders and faculty to benefit discussion, networking and the development of this project.
5. Attract funding from federal and non-federal sources.
6. Accelerate the transfer of information on alternative agriculture systems, as well as further the developmental and publicity goals of SARE at both a regional and national level.
7. Celebrate the successes of sustainable agriculture at the local and regional levels as well as the national level.

Abstract of Results

The major purpose of this project has been to document the human content of SARE-supported research projects since the inception of the program. The most significant contribution of this project are the anthropological research tools: black and white photographs and "life histories." Various configurations of the research data is available to be used to inform farmers, researchers and the public about the value of human resources in on-site farm research projects. Already, the illustrations of the quality of life dimension of agro-ecosystems through photographs and personal stories suggest it is possible for a wide range of citizens to study the impact of agricultural sustainability on the rural social process. Through real-life experiences of farm families and operators who are striving to manage whole-systems agriculture, SARE activities in the western region have been clearly communicated.

Criteria for the first year of funding was to document six or seven SARE-supported projects in the Western region. After discussions with communications specialist Kristen Kelleher, advisor David Schlegel and coordinator Philip Rasmussen, it was decided that nine projects would be documented. The selected projects are: SARE #91-26, grape production, California; SARE #91-23, farmer clubs, Montana; SARE #89-14, dryland cereal, Montana; SARE #88-1, sustainable agriculture resources and networking, Washington, Idaho, Oregon, Utah and Montana; ACE #93-11, dairy, Oregon; SARE #93-34, Navajo Nation sheep project; SARE #91-30, rural development for farmworkers, California; SARE #93-33, Conservation Reserve Program land conversion, New Mexico; SARE #91-28, peach production, California.

Site visits were scheduled between the end of May and the middle of September. After visiting the nine identified projects, a meeting with Kristen Kelleher, Jill Auburn and David Schlegel was held to review contact sheets of photographs. *Since September about 210, 8" by 10" black and white photographs have been printed* (BUT NEVER DELIVERED TO THE REGION — KEEP OR DROP?). All 34 interviews have been outlined for critical content.

The methodology implemented in this project is an effective tool for documentation and accountability of SARE research projects. I recommend the continuation and ongoing development of an institutionalized vehicle which brings project investigators, scientists, farm advisors, extension agents, university faculties and policy makers closer to the human resources involved in SARE research and education.

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Annual Results

ACE #92-9

Comparative Performance and Farm-Level Function of Conventional and Certified Organic Apple Production Systems in California

Location:
North Coast, North and South Central Valley and Central Coast of California

Funding Period:
July, 1992 -

Grant Award:
$175,224

Project Investigator:
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Ed Silva, Corralitos
John Diffenbaugh, Watsonville
Don Chandler, Watsonville
George R. Jewell, Sebastopol
Charles Bertoli, Sebastopol
Perry Kozlowski, Sebastopol
Gregory House, Byron
John Wood, Lamont
Jim Carlisle, Lamont
Jim Erybide, Shafter

Objectives

1) Retain, for multi-year observation, whole systems comparison units of transitional or certified organic and conventional input production as multi-year demonstrations in each of the four important apple production regions in California.

2) Compare potential yield-limiting factors in these systems associated with tree growth and yield, soil characteristics and nutrients, key pests and their associated damage, and natural enemy abundance and response.

3) Demonstrate effectiveness of key management strategies relevant to certified organic production including: codling moth control with pheromone-based mating disruption and microbial sprays; orchard floor management and cover-cropping as a source of soil nutrients and improved structure; and sprayable inorganic or organic compounds and/or cultural substitutions for scab control.

4) Document the economic performance and viability of certified organic production systems or practices in each production region.

5) Disseminate and publish research-based results to the production community, culminating in the publication of the University of California-sponsored "Guide to Certified Organic Apple Production in California."

Abstract of Results

By the year 2,000, California will likely emerge as the second largest apple-producing state in the nation, with a ten percent share of U.S. production and a total harvest of more than 500,000 tons. Apple acreage in California has increased 50 percent in the past two decades, to nearly 40,000 bearing acres.

Making up a small but growing percentage of statewide production, certified organic apple production represents an emerging technical and marketing alternative for California apples. Certified organic and transitional apple production has expanded to over 3,000 acres in California.

An increasing number of California apple growers recognize economic and environmental incentives of organic apple production, such as price premiums in response to consumer demands, and lessening of regulatory impacts on farm inputs. Many commercial growers could profitably convert to organic production if management knowledge and techniques were available to assist them in capturing a high-value position in the marketplace.

In 1992 USDA-SARE funded our three-year, farm-based study of the performance of California organic apple production compared with conventional practices. Our research group, comprised of University of California Cooperative Extension farm advisors and research specialists from each of the major valley and coastal production regions, has completed the field research component of this study, and is now writing the "Guide to Organic Apple Production in California" based on these research results.

In 1995, our apple research group completed the third and final production year evaluation of three certified organic/transitional production demonstrations (North Coast, North and South Central Valley, Central Coast). In addition to these long-term demonstrations, the research group also continued and expanded statewide monitoring of synthetic pheromone-based codling moth mating disruption programs, including evaluation of codling moth monitoring and management programs integrating mating disruption with biological (certified organic) and chemical (conventional) controls. Ancillary research

included testing of certified organic methods of key disease agent (scab) control, secondary pest (rosy apple aphid) suppression, and post-harvest physiological disorder (bitter pit) prevention.

Codling moth mating disruption with synthetic pheromones, either alone or in combination with biological control agents, sprayed materials, and/or sanitation practices, is highly effective as a certified organic control strategy for codling moth in most California production locations. Disease control with sulfur and copper, when application of these materials is properly timed, provides organic growers with scab control as effective as conventional synthetic fungicides in on-farm tests. Horticultural oils, soaps, and botanical insecticides, were effective tools for aphids and secondary pests. Unrefined mineral calcium chloride had effects demonstrably equivalent to synthetic calcium compounds in the suppression of bitter pit in stored apples.

Economic Analysis

Certified organic apple production in California has been demonstrated to be commercially profitable under production conditions observed in this study, but is presently a more costly production system in the coastal regions and the northern San Joaquin Valley. Although economic data are difficult to summarize due to differences in varieties, rootstocks, management systems and yearly market prices for organic fruit, farmgate costs of certified organic production exceed those of conventional apples by 10-25 percent in coastal fresh market systems. Farmgate costs ranged from $3300-$4100/acre for production of Central Coast organic Granny Smith apples. Cost of production studies completed in the coastal production areas calculated total operational costs at $4500-$5100/acre (without overhead). Profitability of certified organic apple production systems depends upon micro-climate, root stock/variety combinations, pest and disease pressure, yields, and market prices. Early-maturing varieties (Gravenstein, Golden and Red Delicious) and high-density semi-dwarf root stock plantings of Granny Smith apples and some newer varieties have been successfully converted to certified organic management, and have shown accumulated net profits equal or higher than conventional comparisons over study years in which price premiums were available for certified organic fruit.

Potential Contributions

Final published project results document the agronomic and economic performance and feasibility of certified organic apple production in several California regions. In many cases, yields and quality are maintained in organic production systems by careful application and monitoring of alternative technologies. Research-based guidelines for particular climatic regions are being developed to avoid over-generalization. Profitable apple production systems which substitute biologically based inputs for synthetically-derived pesticides and fertilizers now serve a growing consumer public in California and national and world markets. Published management guidelines will strengthen grower confidence and lower inherent risks during the process of conversion to these practices in California.

Producer Adoption

At twenty sites statewide, grower collaborators have adopted some or all of project production guidelines. These "focus" blocks have served as the basis for wider dissemination of research-based guidelines for organic production. Project major participants estimate that approximately 350 growers, farm advisors, pest control advisors, and other agricultural professionals have been directly contacted with seminars, presentations, and short course curricula. Major participants held eight extension grower meetings (two each in Watsonville, Santa Rosa, Bakersfield, Modesto; two successive November short course presentations); attendance figures are based on total participation in these meetings.

Farmer/Rancher Comments

"Last year we had severe scab conditions and were able to beat it.. That's a big step forward in saying that the organic deal is viable...[Swezey] got us into the codling moth pheromone program when it was still in the experimental stage, and he was able to really keep track of what was happening during the conversion process."

—Jim Rider; California Certified Organic Farmers Newsletter, Summer 1996.

"It's a safer product...I think it is a way of the future. We felt comfortable with the program we had last year and decided to increase our acreage."

—Dago Oseguera, Diablo Green Orchards, Brentwood Reporter, 8-31-96

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Annual Results

ACE #93-12

Range Monitoring in the Upper Stony Creek Watershed

Location:
Tehama County, Northern California

Funding Period:
September, 1993 -

Grant Award:
$40,000

Project Investigator:
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Objectives

The primary focus of this project is to develop, demonstrate, and achieve rancher adoption of procedures by which they can and will monitor progress or lack of progress toward meeting their landscape goals on the watershed.

1. Document the effect of grazing systems and resulting stocking densities on annual range land ecology by monitoring changes over time in ground cover, canopy cover, soil bulk density, target plant density, residual dry matter, grazing intensity, infiltration rates and erosion.
2. Determine the impact of grazing systems and resulting stocking densities on the riparian profile and vegetation by monitoring changes over time in: stream bank vegetation density and canopy cover; and elevation transects of riparian above and below check dams.
3. Develop, demonstrate, and achieve rancher adoption of procedures by which they can and will monitor progress or lack of progress toward meeting their production and landscape goals.

Abstract of Results

The Glenn and Colusa Resource Conservation Districts initiated a major ten-year project (initially funded by NRCS) involving an entire watershed on private lands. Objectives of the project were to be met by individual ranch practices such as controlled grazing, brush management, stock water development and riparian check dam construction.

This ACE grant supports and encompasses two levels of monitoring within the watershed. The first level is detailed, frequent, and designed for statistical analysis. The second level of monitoring is in fact simple, practical, and economical so that landowners can take on the task of monitoring their own range land. Landowners in the watershed have attended workshops on planning and monitoring on the watershed. Several landowners have been assisted in establishing photographed plots on their ranch.

Detailed monitoring is being conducted at sites on two ranches in the watershed. At each site cattle grazing impacts are being investigated with two replications of three grazing regimes, a high-intensity, short-duration treatment, a no-grazing treatment, and a traditional seasonal-grazing regime. Grazing treatments have been fenced and baseline data has been collected. Range plant cover, canopy cover, and target plant density were determined for each treatment using the "Savory" dart-throw method. Residual dry matter and soil bulk density have also been determined for each treatment. This data has been collected each year and will be compared between treatments and years. Initial analysis indicates that grazing treatments are affecting the age and form of the perennials. More mature and decadent plants have been found in the ungrazed treatments. There appears to be little difference in vegetation composition between the high-intensity, short-duration grazing and the ambient grazing regime.

Detailed monitoring of the riparian profiles was completed in 1990, 1991 and 1994. During these years all treatments were rested, meaning no livestock grazing occurred. In 1995 grazing treatments were applied in the spring. In the fall of that year, riparian profiles were monitored and evaluation of the data is underway. The photographed plots of the riparian area showed that the initial rest period had a profound impact on re-vegatating the corridor.

In the summer of 1995 detailed monitoring was conducted to compare infiltration rates and erosion on sites with annual and perennial grasses. Data collected indicated that the presence of annuals versus perennial grasses and the condition of the range site both had a significant affect on infiltration percent. Infiltration was greater on perennial plots than annual plots (50.5% versus 36.7%, respectively). Erosion on all sites was minuscule.

In cooperation with six other natural resource/livestock advisors in Northern California, a workbook on *"How to" Monitor Your Range land Resources"* has been developed (see Western SARE's "Sustainable Agriculture Resources") and is being demonstrated during the course of this project. Level 1, which instructs ranchers how to monitor with a camera was published in December 1995. Level 2, with more detailed monitoring practices, is in final draft form. During a monitoring workshop conducted with ten landowners, the vegetation monitoring techniques were tested and then revised.

Producer Adoption

Most landowners (18 currently active) in the watershed have received copies of the Level 1 handbook (mentioned above). A project assistant hired in April, 1995 has worked with six landowners in the project to establish permanent photographic points. Three of the landowners have also included in their monitoring effort some more detailed evaluation of vegetation and riparian areas. Several of the other landowners have expressed interest in establishing photographic monitoring methods this year.

Reported in 1996

Western Region
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Annual Results

ACE #94-010

Management of an On-Farm Composting System

Location:
Utah

Funding Period:
July, 1994 -

Grant Award:
$30,000

Project Investigator:
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Objectives

1. Determine the fate of nutrients in an on-farm composting management system
2. Develop a management plan to optimize the value of the composted end-product
3. Demonstrate the management system to local producers
4. Distribute information through the Cooperative Extension Service
5. Analyze the economic and labor requirements of the management system

Abstract of Results

Experiments were conducted at Utah State University in Logan, Utah, from the fall of 1993 to the winter of 1994 to evaluate the feasibility of composting in a cold, arid climate. The windrow method of composting was used on an outside composting pad. Composting appears feasible in a cold, arid climate. However, turning may not be feasible if water cannot be applied to the compost windrows to maintain proper windrow moisture content (between 40 and 60%). There was a significant difference in most of the elements tested between the raw materials and the ending compost. Soluble salts, P, and K levels were high in soils under the intense management regimes. A concrete or asphalt pad to prevent leaching and improve access to the composting site may be beneficial for producers to consider. Results will be useful in facilitating on-farm composting as a dairy waste management practice in northern Utah and more generally, the Intermountain West.

Specific Results

Characteristics of compost at the beginning and ending of the treatments [(a) no turning/no water, (b) no turning/water, (c) turning/no water, and (d) turning/water] were analyzed for NO_3-N, P, K, and soluble salts using an ANOVA for a randomized complete block design.

Concentrations of soluble salt increased during composting in all treatments during the spring and summer of 1994 ($p = 0.05$). Phosphorous concentrations decreased significantly in all treatments ($p = 0.05$) during the spring and summer of 1994. In the fall of 1993, potassium levels generally decreased, especially in the no turning windrows. There were significant ($p = 0.05$) decreases in all treatments during the fall of 1993 and for treatments 3 and 4 for spring of 1994 ($p = 0.05$), and treatment 1 for summer of 1994 ($p = 0.05$). No significant statistical differences were observed in any of the treatments for nitrate for fall of 1993 and spring of 1994. Nitrate levels increased in treatments 1 and 2 during the summer of 1994 ($p = 0.05$)

The soil under the composting site was uniform before the study began. At the end of each repetition, full-profile soil samples were collected under each windrow and analyzed and the differences between beginning and ending values for soluble salts, NO_3-N, P, and K were analyzed using an ANOVA for a randomized complete block design.

There were significant increases ($p = 0.05$) in the soluble salt content from the beginning to the end of the study for treatment 4 (turning/water). Treatment 1 (no turning/no water) had the least observable increases for all treatments in the study for soluble salt concentrations.

Phosphorous concentrations did not increase during individual composting events for all treatments, but did increase ($p = 0.05$) in treatment 4 (turn/water) from the beginning to the end of the study.

Potassium concentration levels increased ($p = 0.05$) during each repetition for treatment 4 and form the beginning to the end of the study, but not in treatments 1, 2, and 3. Similarly, nitrate levels did not increase in any of the treatments during individual composting events, but did increase in treatment 2 (no turning/water) ($p = 0.05$) from the beginning of the study to the end of the study. Turned treatments were observed as having lower values for nitrate than the no-turning treatments.

Composting in a cold, arid climate such as northern Utah appears feasible with moisture as a limiting factor. The cold, arid climate of the Intermountain West provides a wide range of environmental conditions, which producers must consider when managing compost. In the spring, animal wastes are high in moisture content (>80%), and considerable amounts of drier materials must be added to lower the moisture level for proper composting. Also, wetter materials must be turned more frequently than normal to facilitate drying. During the summer months when water is limited, windrows should be turned when evaporative losses are low (at night, or after a rain event). The relationship between composting and moisture management warrants additional study.

There was a significant increase in soil nitrate levels in treatment 2 (no turn/water) throughout the study. Phosphorous, potassium, and soluble salt concentrations differed in soils under treatment 4 (turn/water) throughout the study. Thus farmers who are using an intensive management system may be advised to construct a concrete or asphalt pad for composting to prevent leaching and to improve access to the composting site.

Two key elements that do not receive much attention when managing soils are phosphorous and potassium. Potassium requirements of plants are high during early stages of growth, and it is important to provide adequate (but not excessive) amounts. Compost contains relatively large amounts of potassium and should be applied on the basis of soil tests. Heavy applications of compost may exceed plant requirements of phosphorous and potassium may lead to other problems in the soil or future crops.

Soluble salt concentrations in the compost were as high as 34 mmhos/cm for some of the individual treatments in the study and the salt content of compost should also be considered when applying compost to the soil. It is not always possible or practical to eliminate all salts from the soil, but managing the soil and the amount of compost applied to the soil may help to minimize salt damage in soils and to plants. Maintaining a high water content in the soil, near field capacity, dilutes salts and lessens their toxic and osmotic effects (Donahue, Miller, & Shickluna, 1983). Thus, irrigating soil lightly but frequently to elevate moisture content during the salt-sensitive germination and seedling stage should help, plants tolerate salinity associated with compost. If large amounts of compost are applied, some salt will accumulate in the soil surface or furrow ridge tops as water moves upward and evaporates.

Potential Contributions and Practical Applications

This project provides scientific information and demonstration of an alternative animal waste treatment method. The practice provides farmers with a management tool to improve water quality and enable the producers to treat wastes and possible develop a positive cash flow from there waste management system. The practice seems particularly suited to confined animal operations which have limited access to land for direct disposal of waste products.

Reported in 1996

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Annual Results

ACE #94-020

Rotational Management of Wetlands and Cropland in the Tulelake Basin

Location:
Tulelake Valley, California-Oregon border

Funding Period:
January 1994 -

Grant Award:
$259,633

Project Investigator:
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Cooperators:
Tulelake Irrigation District:
Lease Land Issues Committee
A group of ten farmers, agricultural industry and irrigation district representatives.

Objectives

1. Conduct pilot studies to assess the feasibility of wetland/cropland rotation (flooding of existing cropland to create new wetlands, and drainage of existing wetland to create new farmland) as a long-term management option for sustainable co-existence of irrigated agriculture and wetland reserves in the Tulelake basin.
2. Determine the impacts of wetland/agriculture rotations on: water quality, seasonal dynamics of nutrient release/immobilization, pesticide residue movement, crop productivity, development of marshland vegetation and the quality of wildlife habitat created.
3. Compare the ability of managed wetland systems and irrigated cropland to remove or immobilize nutrients and other residues from agricultural drainage water.
4. Test the utility of short-term flooding cycles to control soil borne pathogen and nematode populations within irrigated cropland rotations, and determine the extent of use of these temporary wetlands by wildlife.
5. Assess the socio-economic impacts and policy implications related to rotational wetland/agriculture management systems.
6. Coordinate the project with other research/planning activities in the Klamath Basin, and involve different community groups, state and federal agencies and other organizations in the development of the pilot projects.

Abstract of Results

Tulelake is a high mountain valley on the California-Oregon border where 44,000 acres of irrigated agriculture exist adjacent to the 13,000-acre Tulelake National Wildlife Refuge. The refuge is a critical part of the Pacific flyway, and with Lower Klamath Refuge, supports one million migrating waterfowl, annual waterfowl production of 40,000, and habitat for 411 wildlife species. Some concerns facing the basin include: degeneration of wetland habitat; pesticide use; declining populations of endangered fish; and declining crop productivity due to build up of nematodes and other soil disease agents.

Improved management strategies to sustain agriculture and provide high quality wildlife habitat are needed. One strategy proposed is to flood areas of existing cropland to create new diverse wetlands, and drain areas of existing wetland to create cropland free of soil borne pathogens. This project will establish pilot studies to assess the feasibility of cropland/wetland rotation in terms of crop production, pathogen control, quality of wildlife habitat created, effects on water quality, and socio-economic impacts.

Various management options for newly-created wetland and cropland will be tested, and their abilities to remove nutrients and pollutants from agricultural drainage water compared. Major goals of the project are to strengthen communication among different sectors of the local community, including producers, federal/state agencies, researchers, and other organizations active in Klamath Basin issues; and, to incorporate different community perspectives into the study as it develops.

During the first year of the project, baseline soil and water sampling of the pilot sites has been completed, and wetland/cropland rotational management approaches were initiated. A digitized base map of the

basin is being developed in cooperation with the U.S. Bureau of Reclamation office in Klamath Falls. Field station experiments were established in 1994 and 1995 to determine which species may be useful to use as cover crops in the cropping phase. This cropping approach has the combined goals of nematode (pest) and weed suppression, provision of duck nesting habitat, and reduced spring wind erosion. A number of public meetings were held to discuss the project with the local community. As a result, a committee comprised of ten farmers and agricultural industry and irrigation district representatives was formed to work on the project and with other groups involved in managing the leased croplands within the Tulelake Wildlife Refuge.

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Annual Results

ACE #94-033

Influence of Cover Crop and Non-Crop Vegetation on Symphylan Density in Vegetable Production Systems in the Pacific Northwest

Location:
Pacific Northwest

Funding Period:
July, 1994 -

Grant Award:
$100,000

Project Investigator:
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Objectives

1. Determine the effect of specific cover crops on symphylan (a pest of vegetables) density using three cropping scenarios: fall-planted crops, no-tillage; fall-planted crops, spring incorporated (or turned under); and spring-planted crops, undisturbed.
2. Develop and test (pest) trapping techniques, using baits or attractants that may help determine symphylan density in the field and contribute to more environmentally-sound and effective means of control methods.
3. Characterize the unique community structures and key crop nutrition levels present in areas of high and low symphylan density.
4. Determine the influence of cover crops and green manures on populations of a predatory mite (or beneficial insect) of the garden symphylan, Pergamasus quisquiliarum.

Abstract of Results

Cover crops Micah barley, Wheeler rye, Monida oats and white mustard were both fall- and spring-planted, preceding sweet corn, in no-till and conventional tillage production systems. Soil samples were taken within the sweet corn row approximately six weeks after planting and again at harvest. Soil arthropods (insects and other pests) were extracted and counted from the soil samples. In one trial, the impact of cover crops on the abundance of the symphylan pest were evaluated in a traditional green manure system and a system with no spring disturbance other than opening the soil for planting (no-till). Symphylan density was decreased by spring oats, unaffected by barley, slightly increased by winter cereal rye and dramatically increased by white mustard compared to treatments without a cover crop. Plots with spring tillage had fewer symphylans than no-till plots.

In another test, cover crops were planted in late spring and desiccated with glyphosate ten days before sweet corn was planted into undisturbed cereal residues. Symphylan density was determined prior to cover crop planting, and six weeks after planting. The change in symphylan amounts from a first to second sampling period was most for cereal rye and least for spring oat crops. The change in symphylan density in the spring oats was actually less than in plots treated with the soil insecticide Dyfonate.

Several soil traps for determining symphylan density were designed and tested in the field as well. In areas with a high number of the pests, a wire mesh bag adequately attracted symphylans with a number of seeds used as bait. However, in tilled conditions, these traps were much less effective. Attempts to install permanent traps in the soil that could replace bait during the season did not work well. The best system for trapping was use of a fresh cut potato placed on the soil surface.

Soil samples were taken from two sites. At one site the grower did not apply Lorsban insecticide in one of every four rows of sweet corn. We took soil samples from areas in this row that were both damaged by symphylans and areas where corn growth was normal. This field had a history of symphylan trouble and the grower suspected that the poor corn emergence was due to the pests. However, there was a very poor correlation between the number of symphylans and the amount of damage to the corn. Interestingly, the highest symphylan population was in an area with no corn damage. However, the total number of organisms per unit volume at this site was nearly three times that of adjacent areas.

At another farm site, we took soil samples from a pumpkin field that was totally devoid of crop plants, and then compared the (soil) community structure to areas immediately adjacent that were productive. Symphylan density was highest in the affected area. Of the other soil organisms present, predacious mites were most abundant where symphylans were present, and fungal feeding springtails were most abundant where no symphylans were found. There were no differences detected between samples for bacterial and fungal biomass.

Pergamasus quisquiliarum mites were extracted from samples taken in cover crop plots. Mite densities were very low at the beginning of the season but increased steadily through November. However, this arthropod was found only where soil disturbance (spring plowing and tillage) was eliminated and cover crop residues remained on the surface. The number of P. quisquiliarum was closely correlated with cover crop biomass remaining on the soil surface.

Among other findings, these early trials found that populations of important predators such as centipedes and mites were greatest where cover crop biomass was highest. This abundance of beneficial predators was independent of the tillage system used. Cover crop residues also impacted soil microbial communities. Bacterial and fungal biomass were highest in plots with a cover crop. Microscopic analysis of roots indicated that symphylan damage to roots was less in areas with high fungal biomass compared to plots with low fungal biomass, even when symphylans were present.

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Final Results

SARE #92-31

Grazing Strategies for Sustainable Ranching Systems in Western Semi-Arid Zones

Location:
Grant County, Oregon

Funding Period:
October, 1992 - May, 1996

Grant Award:
$237,738

Project Investigators:
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Rancher Cooperators:
Holliday Ranches; Bear Valley Ranch; J.C. Oliver; Ponderosa Ranch.

Objectives

1. To collect biological, hydrological, management, and economic baseline data for traditional and both management intensive and capital intensive grazing systems designed to maintain or enhance riparian and adjacent upland zone conditions;
2. To monitor performance of variations of the identified ranching systems for two full growing seasons;
3. To determine the impact of alternative grazing strategies on ranch and livestock performance on riparian zone and adjacent upland conditions, and on fish and wildlife habitat;
4. To identify constraints on adoption of "best whole ranch management practices" for ecologically compatible grazing strategies in riparian zones and adjacent uplands which may be resolved through either research, user education, and/or through management and policy changes;
5. To develop guidelines for the design and implementation of alternative whole ranch grazing system, grazing intensity, and distributional control strategies; and,
6. To prepare relevant audiovisuals, supporting user-oriented publications, and conduct on- and off-site demonstrations and educational programs on "best management practices" to encourage transfer of viable intensive grazing system technologies.

Abstract

The study area is located in Grant County, Oregon. Twelve experimental units were identified in the study area based upon 1) site similarity, and 2) management intensities which were in place for at least five consecutive years. The three treatments consisted of a similar meadow vegetation with woody willow components associated with the riparian zone. Treatments represent a primarily herbaceous vegetation cover currently managed under a summer season-long grazing system; a primarily discontinuous woody plant cover near the riparian zones currently managed under a summer short-duration/rotation grazing system; and, a primarily continuous woody plant cover currently managed under a fall short-duration grazing system. Four replicates of each treatment were identified.

The concept of "bankfull" was found to be a non-repeatable field measure. It is, therefore, a poor benchmark for a stream classification scheme. Stubble height measurements are a direct indicator of the impact of grazing and haying on the riparian meadow. Analysis of the data showed a significant difference between summer season-long, summer short-duration, and fall short-duration. Forage production in semi-wet low production and semi-wet high production communities were analyzed, as were percent bare ground, litter, dominant species, and basal cover. The effect of irrigation practices on stream flow and temperature was analyzed. Non-equilibrium ecological theory satisfactorily represented ecological structure within the herbaceous riparian meadows.

Both bird and mammal communities displayed specific associations with riparian vegetation structure. On a pasture scale, management practices that maintain, restore or enhance willow vegetation will result in the greatest wildlife diversity and abundance.

Economic Analysis

Based on economic and biological information collected from cooperating ranchers as well as secondary information, the profitability of five grazing plans was evaluated over a six-year period. Although the results showed slight differences in profitability between the grazing plans, the differences were so small and so sensitive to changes in some parameters (in particular forage yields) that the differences cannot be viewed as significant.

Economic sustainability was defined as being established if the rate of long-term returns to ranch investment is at least three percent (one-half of the opportunity cost of capital as measured by the annual yield rate on 10-year U.S. Treasury notes). Given this criterion for economic sustainability and given, further, the then (1993) existing price/cost relationships, the ranch operation was found to be sustainable under all grazing systems examined.

A doubling of grazing fees did not cause the ranch to be economically unsustainable; however, a 30 percent reduction of the public land grazing permit did result in the loss of economic sustainability under all grazing schemes.

In 1995/96, four enterprise budgets were prepared to further examine economic sustainability. The enterprise budgets are for cow/calf operations with 50, 100, 300, and 500 cows, respectively. Production conditions considered are those existing in the mountain region of northeast Oregon. The project site, Bear Valley, is located in that region.

One of the four budgets prepared for the mountain region encompassing Bear Valley is representative of the size class prevalent in Bear Valley: the 500 cow (25 bulls, 10 horses) enterprise budget. This budget reveals that the leading per cow annual cost items in the mountain region are winter hay feeding costs ($127.35) and annual family labor costs ($54.00 per cow). Combined, these two cost items account for about 58 percent of annual variable plus cash fixed costs for a representative cow/calf enterprise. Therefore, only if a grazing strategy significantly affects either hay production/feeding or family labor costs is it likely that an alternative riparian grazing management program will significantly influence ranch productivity. These findings confirm the basic conclusions drawn from the ranch survey and whole ranch analysis completed in the previous year.

The budgets reflect the lower cattle prices in 1995/96 (relative to prices in 1993). These prices are approximately 10 percent lower. Given these lower prices and after accounting for the value of family labor ($27,000 per year), the ranch, although returning a positive return to ranch investment, is no longer economically sustainable (if economic sustainability is defined as a previously, namely, one-half the opportunity cost of capital as measured by the annual yield rate on 10-year U.S. Treasury notes).

Potential Contributions

At a pasture level, maintaining or increasing a balance of herbaceous and willow dominated vegetation along riparian areas where the species is absent will increase both the total density and diversity of bird species and will increase the diversity of small mammal communities. Haying results in a significant decrease in survival of montane voles, which are competitors for livestock forage.

Grazing systems can be defined so that ecological as well as economic sustainability are achieved. Although recently developed enterprise budgets show absence of economic sustainability due to low prices, long-term sustainability is achieved with the likelihood of higher prices in the long-run.

New Hypotheses

Because of the close association of western jumping mice to willow habitats we suspect that populations occurring in small isolated patches of willow would be at risk of local extinctions. We predict that occurrence and persistence of western jumping mice would be inversely related to patch size and isolation. We further predict that diversity and abundance of nesting bird species would increase with willow patch size; and, that habitat quality, as measured by reproductive success, would increase with willow density and volume for the three riparian shrub obligate nesters identified in this study. At a pasture-level scale, management practices that maintain, restore or enhance willow cover will increase both wildlife abundance and diversity. The contribution of herbaceous riparian pastures to local, watershed, and regional wildlife diversity needs further study.

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Final Results

SARE #92-4

The Sustainable Farming Quarterly (SFQ), a Regional Newsletter

Location:
Oregon, Washington, Idaho, Montana, Wyoming and Utah

Funding Period:
October, 1992 - September, 1995

Grant Award:
$17,500

Project Investigator:
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Objective

To accelerate the transfer of regionally appropriate sustainable farming technical information to producers, agriculture researchers and technical assistance providers in the six-state area of Oregon, Washington, Idaho, Montana, Wyoming and Utah.

Abstract of Results

The Alternative Energy Resources Organization published the *Sustainable Farming Quarterly* (SFQ) from December 1989 through July 1995. The SFQ began as part of a USDA Western SARE, six-state cereal-legume project coordinated by WSU. AERO acquired funding directly from SARE the last three-and-a-half years, which this report covers. The SFQ continued to focus primarily on the latest in cereal-legume cropping systems, but highlighted other systems on occasion.

At the time we ceased publishing the SFQ in mid-1995, it was reaching over 1,900 farmers, ranchers, Extension personnel, Natural Resources Conservation Service staff, university researchers and news editors, primarily in the Inland Northwest and Northern Rocky Mountain regions. Our readership continued to expand, both regionally and nationally, throughout the life of the project. The eight-to-twelve page quarterly presented research findings, results of on-farm research and demonstration, farm profiles, innovative farmers' experience and knowledge, and timely information on sustainable agriculture activities and programs in this region pertaining particularly to cereal-legume cropping systems. The SFQ solicited articles from scientists, farmers and government agencies. Sally Hilander and David Granatstein served as editors.

Under this contract, AERO published eight quarterly issues. Even though interest in the SFQ remained high and the mailing list was growing, we chose to cease publishing the SFQ when our SARE funding ended. The development time and resources involved in achieving self-supporting status for a publication with a relatively small circulation was daunting, and not our highest priority.

In a story about the passing of the SFQ in the final issue, writer David Granatstein of WSU reflects on the evolution of sustainable agriculture and the region's various perspectives on it over the course of the SFQ's life. He closes by writing, "Agricultural problems are more about people than technology. Sustainable agriculture as a concept, a long term goal we may never fully achieve, recognizes this. I hope that the SFQ has provided both practical ideas for growers and optimism about the future of farming in our region."

Specific Findings

According to reader surveys and interviews conducted by AERO, the SFQ was a useful source of information for professional agriculture advisors, scientists, and farmers. The SFQ kept its readers informed about the new directions in agriculture and exposed them to new ways to solve problems. Articles on research activities and outcomes rated the highest in popularity. SFQ recipients overwhelmingly saw the SFQ as a unique source of information—delivering information they did not get elsewhere.

The Extension Service offices in Washington, Idaho, Montana, Utah, Wyoming and Oregon, and the Montana Natural Resources Conservation Service circulated the SFQ to all their field staff and offices. Individual subscribers, farmers and scientists mostly, made up the rest of the readership.

Cover stories featured in the SFQ during the reporting period included wild oat control in small grains, on-farm testing methods, economic analysis of alternative cropping in dryland grain systems, the economic competitiveness of sustainable farming, non-chemical weed control, erosion control in sugarbeets, chaff collection at grain harvest, biological weed control, and a comparison of alfalfa to annual legumes for soil-building. Each issue also included an events calendar and references to resources about sustainable farming pertinent to the region.

Dissemination of Findings

The SFQ was an excellent vehicle for disseminating the findings from SARE-sponsored and other sustainable agriculture research from throughout the region. It helped keep scientists connected to one another's work, and provided easy-to-access resources for Extension and NRCS field staff working directly with farmers. Farmers also received timely updates on sustainable agriculture research applicable to the region directly through the SFQ. The events calendar kept farmers and agency/university professional staff aware of educational events and networking opportunities as well.

Site Information

The farm and landscape ecology that were typically featured in the SFQ are dryland and irrigated small grain operations in the Columbia and Missouri River drainages that flank the Northern Rockies. While the Palouse region tends to have more precipitation, the region as a whole is semi-arid, with an average annual precipitation in the 10 to 20 inches range. Summer fallow is widely practiced in much of the region. The physical geography varies widely, creating many micro-climates. This variability influences the type of agricultural practices used. Farms tend to be large in terms of acreage. For example, the average dryland farm in north central Montana is over 2,200 acres.

Farmer Evaluations

In general people complimented the SFQ for covering on-farm test results and the specific sustainable practices being used in this region. Examples from AERO's 1993 reader survey include a Montana farmer saying, "all (articles) are interesting and useful for keeping me informed of new approaches to solving problems." One agricultural researcher suggested the SFQ join with Western Farmer-Stockman publications and designate a section for sustainable agriculture. A Washington State farmer commented, "It is important that sustainable agriculture has a medium to inform and educate farmers, scientists and political decision-makers about sustainable farming practices. This needs to be accomplished by using scientific research, and on-farm testing by farmers working with scientists. The SFQ is the best medium to inform all people who use the land, and the politicians to accomplish this media goal. I suggest you broaden your mailing list to include all Washington, D.C., senators and congressmen. Their aides need this information."

Reported in 1996

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Final Results

SARE #94-022

Western Region Community Supported Agriculture (CSA) Conference

Location:
California/Western Region

Funding Period:
July, 1994 - December, 1995

Grant Award:
$23,991

Project Investigator:
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Steve Moore, farmer;
Kerstin Ohlander,
Agriculture & Community
Project;
Gail Feenstra
UC SAREP;
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UC Small Farm Center

Objectives

1. To organize the Western Region Community Supported Agriculture (CSA) conference for existing family farmers, aspiring farmers, students of sustainable agriculture, community groups, educators, advisors, and consumers, and anyone interested in sustainable agriculture.

2. To provide practical information on family farm conversion to CSA.

3. To improve the understanding of this increasingly popular model for small scale agriculture through reflection at the conference.

4. To publish summaries of the conference in the newsletters of the following organizations: UC SAREP, CAFF, CSA International, CSA of North America, American Community Gardens Association, Homeless Garden Project, and the UCSC Center for Agroecology and Sustainable Food Systems.

Abstract of Results

With financial support from SARE, coupled with the invaluable contributions of time and talent from members of the planning committee, a successful Western Region Community Supported Agriculture (CSA) conference was held at the Fort Mason Center in San Francisco, CA from November 12 - 14, 1995.

Over 460 people attended, with farmers as the primary participants (275 producers). Other attendees included students, community members/organizers, non-profit representatives, researchers, and journalists.

The conference program had a good blend of the practical and philosophical underpinnings of operating a CSA. There was much discussion of how CSA farms sell shares in the production of the farm to consumers, and how each member then receives a weekly box of mixed produce directly from the farmer. Distribution systems included the boxes being delivered from a rural area to the urban members, or farms on the urban fringe or inside the city having people come directly to the farm to pick up the produce.

One attendee, Annie Main of Good Humus CSA in Capay, CA., said it best, "This conference has been more than how to start a CSA or the nuts and bolts of CSA. It has been the realization and articulation that it is time to revitalize and start to live the definition of the word community: to listen from our hearts, and to love and care for each others needs — to start living together."

With unprecedented attendance for a Western CSA Conference, there is evidence of a growing population that is interested in meeting one another and helping each other develop sound community supported agriculture projects. Nationally, it is estimated that there was a 12 percent growth in CSAs in 1995.

We also found that there are key issues facing CSAs that became apparent during the conference, which include but are not limited to:

acquiring, holding, and passing on land in a way that reflects similar public-private partnerships; adopting the appropriate legal business most appropriate for a CSA; offering the traditional apprenticeship model — labor barter for learning the trade — while still maintaining legal status with the IRS and being free of potential apprentice liability suits in case of injury; securing long-term, low-interest loans for capital improvements that keeps the interest on such loans revolving within the community; and,

increasing CSA accessibility to low-income, urban neighborhoods.

Lastly it was found that the general public is receptive to the CSA idea and is willing to attend lectures concerning CSAs as well as join a local CSA when they find out how to become a member.

Dissemination of Findings

The results of the conference have been reported in various newsletters and journals including, The Agrarian Advocate, a newsletter by the Community Alliance with Family Farmers, The Cultivar, a newsletter by the Center for Agroecology and Sustainable Food Systems, PANNUPS, an internet newsletter by the Pesticide Action Network, among s.

Potential Contributions

Bringing a large number of people together, united by the CSA concept, triggered an excitement and inspiration for the advancement of the CSA movement. Resulting were specific actions that can be seen as contributions to Community Supported Agriculture, including new CSA alliances and coalitions in specific regions where clusters of CSAs exist. For example, a number of Portland CSA farmers announced that they would meet for dinner one evening of the conference. At the dinner, they realized that they would want to continue meeting and working on regional projects that would benefit all the local CSA projects. This kind of cooperation among CSA farmers has been discussed as a positive shift away from the kind of competitive and divisive nature of the conventional marketing atmosphere that prevails for most small-scale organic farmers.

There also seemed to arise an interest in the further development of the CSA member community. Most CSAs in the Western Region are farmer-initiated, which has also meant that most of the responsibility of making the CSA successful has rested upon the shoulders of the farmers. Originally the CSA concept arose out of the notion that the community can begin to take on responsibilities for making the CSA work, especially outreach and education, thus enabling the farmer to focus on doing the best job they can farming in an ecological manner. We have heard of a number of cases where the farmers were planning on organizing meetings to recruit members who could help run the CSA. This kind of community organizing could be seen as a potential contribution to CSAs.

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Final Results

ACE #91-05

Soil Bacteria to Control Jointed Goatgrass in Integrated Cropping Systems

Location:
Dryland region of Pacific Northwest, near Pullman, Washington

Funding Period:
January, 1991 - December, 1994

Grant Award:
$60,000

Project Investigator:
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Objectives

1. Develop the use of soil bacteria as an alternative management tool to control jointed goatgrass with emphasis on winter wheat.
2. Determine the influence of environmental stresses on the activity and survival of weed-suppressive bacteria.
3. Determine the economic impact of jointed goatgrass densities and the effect of bacterial treatments on yields of winter wheat and other rotation crops.
4. Develop a management technology that integrates weed-suppressive bacteria with cultural and chemical methods for economic control of jointed goatgrass in small grain cropping systems.
5. Transfer to growers and industry the technology of using weed-suppressive bacteria to control jointed goatgrass in small grain cropping systems.

Abstract of Results

Jointed goatgrass (*Aegilops cylindrica*) is fast becoming a major threat to fall-sown small grains and now infests an estimated 5 million acres in the U.S. and reduces growers net income by $145 million annually. Selective herbicides for its control are not available and the only alternatives are intensive tillage, which increases erosion, or spring cropping which reduces crop diversification and grower's profits.

The objective of this research was to develop a novel and safe biological weed control technology that should significantly reduce costs and the need for tillage and chemical herbicides to control grass weeds in small grain crops. Six bacterial isolates were studied in depth. In greenhouse studies, weed-inhibitory bacteria reduced jointed goatgrass growth from 30 to 70 percent. In 1993 and 1994 field trials, several isolates tested were effective in reducing emergence of the jointed goatgrass. In 1993, two of the four isolates suppressed above ground growth by 20-30 percent. In 1994, three of the six isolates suppressed jointed goatgrass above ground growth from 27 to 75 percent.

No root data was taken. We also have found that different jointed goatgrass accessions, collected from various sites in the Western U.S., were more diverse in their response to the inhibitory bacteria than other weed species, which may indicate a greater genetic diversity of this weed than had originally been suggested. Greenhouse and field studies showed that the bacteria in combination with induced plant stresses such as reduced level of herbicides or root growth inhibitors were more effective in reducing plant growth than either treatment alone. We have found the bacteria to be more inhibitory when used in combination with sublethal doses of a synthetic chemical herbicide.

We followed the survival of introduced bacteria in soil and on roots. Fall introduced bacteria declined in the soil to near or below detection during the winter, but increased in the spring. The bacteria colonized roots during the fall, winter, and spring then declined with summer. Even though the bacteria in the soil declined to below detection, a sufficient population was present to colonize the root. We also investigated the use of delivery systems. When encapsulated in various formulations, bacterial survival increased 20 to 40 percent. Desiccation tolerant strains were better able to survive low moisture, thus may be better suited for field application. Using soil microorganisms to control weeds or for other agricultural purposes

is a promising alternative method to reduce crop production costs, decrease dependence on pesticides, and increase the use of environmentally sound practices.

Site Information

This research was being conducted in the Pacific Northwest in the dryland agriculture region characterized by deep loessial soils, and rolling terrain. This area is predominated by winter wheat produced in a three year rotation with spring barley and cool season food legumes. Average annual precipitation ranges from 8 inches to 24 inches. Organic matter content of the soil ranges from 1 to 3 percent. The bacteria selected vary in their survival and colonization in the various soil types.

Potential Contributions

This study is helping to develop and implement a novel and safe biological weed control technology that should significantly reduce costs and the need for tillage and chemical herbicides to control grass weeds in small grain crops. The only alternatives for weed control are intensive tillage, which increases erosion, or spring cropping, which reduces crop diversification and grower's profits. Besides lower input costs, the biological control technology should help growers reduce erosion and water pollution by enabling them to use conservation cropping systems. These types of systems are both profitable and ecologically sound while maintaining water quality.

This research has a much larger outcome than just weed control. This work will foster an extension of the new knowledge of microbial processes such as survival in soil, specificity, secondary metabolite production, and rhizosphere colonization. This information can be used for other research purposes such as utilizing microorganisms as a mechanism for delivery of any desired compound to the root surface. It can also help scientists to understand how the soil microbial component can be managed to reverse soil degradation and aid in maintaining a healthy and productive soil.

Farmer Adoption

This technology requires a paradigm shift on the part of the user group because weed control is occurring without the sole use of a synthetic chemical. In this biocontrol system, synthetic chemicals are replaced or used at a reduced rate in conjunction with the biocontrol agent. Until now it was considered necessary to have near 100 percent control of the weed. When one considers the impact microorganisms can have on the competitive abilities of a plant by just suppressing plant growth, total control of the weed population is not required. The competition of the crop with the weed is a major concept in this biocontrol system, which involves consideration of the ecology of both the weed and the bacteria for successful weed control. This plant-microbe interaction along with the weed-crop interaction will effectively reduce the weed pressure and attain the true yield potential.

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Final Results

ACE #92-6

Cover Crops Incorporated with Reduced Tillage on Semi-Permanent Beds: Impacts on Nitrate Leaching, Soil Fertility, Pests and Farm Profitability

Location:
Salinas Valley, California

Funding Period:
August, 1992 - July, 1995

Grant Award:
$133,200

Project Investigator:
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Objectives

1. Quantify the potential for new cover crop/reduced tillage systems on semi-permanent beds to improve nitrogen cycling and decrease nitrate leaching as compared to conventionally farmed systems.
2. Compare vegetable crop yields on cover-cropped/reduced tillage and conventionally-farmed management systems.
3. Develop innovative reduced tillage practices that minimize time and energy requirements for cover crop incorporation.
4. Determine positive and negative effects of cover crops and reduced tillage on disease and insect pests.
5. Calculate costs and benefits of each management system to determine relative profitability, energy savings, and labor requirements associated with using cover crops and reduced tillage on semi-permanent beds, using a computerized budget generator (Budget Planner).
6. Use a soil/plant process model (EPIC) to assess short-term and long-term effects of using cover crops and reduced tillage on crop productivity, leached nitrate, and profitability.
7. Conduct field demonstrations and local meetings, and prepare publications to inform growers of the environmental advantages, management feasibility, risks, and profitability of adopting cover crops and new tillage practices.

Abstract of Results

Development of new management practices is necessary for annual row crops, which use large amounts of nitrogen and water, and create a high potential for ground water contamination by nitrates. Our previous work has shown that in intensive vegetable production systems, winter cover crops can deplete soil nitrate during the winter rainy season, and improve soil nitrogen recycling after incorporation, even when there is only a short fallow (unseeded) period between vegetable crops. One purpose of this project is to develop cover crop management techniques, including reduced tillage on semi-permanent beds, which are cost-effective and practically suited to intensive vegetable production schedules.

Research plots were established in 1992 at three commercial farm sites (two-year studies), and at two experimental sites (one-year studies). The on-farm sites were cover cropped during the winters of 1992-93 and 1993-94, and then planted with two successive vegetable crops in both years. The studies at the experimental sites were conducted to determine the effect of cover crop incorporation on microbial carbon and nitrogen dynamics, and subsequent crop yield where management conditions could be more closely controlled. The soil types at these sites ranged from loam to clay.

Cover crops reduced nitrate leaching during winter by as much as 70 percent compared to winter fallow soil, due to plant nitrogen uptake and to reduced drainage resulting from plant transpiration. High nitrate levels in the lower soil depths of the fallowed plots persisted at all sites into the early stages of vegetable production, when frequent irrigation may cause further leaching. The short-term effects of cover crop incorporation, including plant nitrogen availability, insect and disease incidence, and soil nitrogen and microbial biomass, were the focus of intensive post-incorporation soil sampling at all sites. This data suggests that the effects of one year of low carbon/nitrogen cover cropping are short-term and temporary, and are usually not detectable by the time the first cash crop is planted. Only one site produced a significantly higher lettuce yield and nitrogen content after one year of cover cropping. Sustained differences in soil nitrogen content and microbial biomass were found to extend into the vegetable crop period after two successive years of cover cropping on the clay loam soil.

Studies at the experimental sites showed if cover crops have a low carbon/nitrogen ratio at the time of incorporation, cover crop nitrogen may be rapidly mineralized, and contribute significantly to crop available nitrogen. However, if cover crops with a high carbon/nitrogen ratio are incorporated under low soil moisture conditions, delayed nitrogen cycling dynamics may actually reduce crop available nitrogen compared to fallowed soils in the early growth stages of the subsequent crop.

At the on-farm sites, other impacts of cover cropping were also measured. Increases in certain soil arthropods (insects) and funguses, which were found in some cover cropped plots after incorporation, did not last into the vegetable cropping period, and had no effect on crop yield.

Economic Analysis

Detailed management input records were compiled for each commercial site to allow a comparison of energy use, labor requirements and costs of cover cropping, using a computerized budget generator. The cost of cover cropping was found to be minimal relative to the cost of producing a vegetable crop (3-5%), and approximately 14 percent of the costs were for management operations required on winter fallowed ground, such as listing beds and cultivating furrows. It appears that the more significant risk in winter cover cropping lies in the potential for lost revenue if the cover crop disrupts the vegetable planting schedule.

The window of opportunity to grow and incorporate a cover crop, and then prepare the field for vegetable planting is very short in this production system. The use of semi-permanent beds and minimum tillage techniques may be the critical management component to make cover cropping a viable option in intensive vegetable production.

Potential Contributions

Management techniques to grow and incorporate cover crops on semi-permanent raised beds have been developed and demonstrated for intensive vegetable production systems on commercial sites. This study has shown that cover crops significantly reduced nitrate leaching during winter. The use of cover crops to deplete soil nitrate, and thereby reduce the potential for nitrate contamination of ground water during winter rains has been demonstrated for a range of soil types. No yield reduction or increase in disease incidence of vegetable crops has been found as a result of cover cropping.

Cover cropping on semi-permanent beds may reduce cultivation requirements compared to planting and disking on flat ground, and therefore save energy and labor costs.

Producer Adoption

Winter cover cropping is becoming more widespread in the Salinas Valley, as the threat of nitrate leaching to the ground water becomes more widely known, and the value of building soil fertility through the addition of organic residues becomes more accepted. This project has generated interest, evidenced by high participation at field days, and an increasing number of growers now planting winter cover crops on raised beds and using minimum tillage techniques at incorporation.

All of our cooperators are growing winter cover crops as a result of their participation, and two of them are committing substantially more acreage in addition to our research sites to cover crops. We have received at least ten requests for cover crop seed; several offers of commercial sites from different growers for future cover crop research, including drip irrigated sites; interest from the largest local fertilizer/farm service company in management techniques to reduce nitrate leaching; and, interest from a seed company in becoming a local source for cover crop seed.

New Hypotheses

Further research is needed on modifying tillage practices to improve nitrogen cycling. Data from this study has revealed that a significant, short-term surge and decline in nitrogen cycling result from the first spring tillage in these intensively-managed, highly-tilled cover cropped and fallowed soils. It is hypothesized that this is caused by microbial stimulation in response to the mixing and aeration of tillage, and then exhaustion of the supply of water or carbon, causing the microbial population to die back. Further research is needed to determine the extent of nitrogen loss, and how tillage practices can be modified to increase soil carbon and nitrogen retention.

Also, minimum-tillage techniques have been shown in this study to provide several advantages, such as allowing earlier entry into the field under wet conditions, and reducing operating costs compared to conventional disking. Further research is needed to determine the optimal tillage practices to reduce soil compaction in vegetable production, which in turn will effect nutrient cycling, drainage, disease incidence and more.

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Final Results

ACE #92-7

Role of Soil Microbial Biomass and Microbivorous Nematodes in Functioning of Sustainable Agricultural Systems

Location:
Davis, California

Funding Period:
December, 1992 - January, 1996

Grant Award:
$156,731

Project Investigators:
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Objectives

1. Compare microbial biomass/activity and nematode numbers and diversity in organic, low-input and conventional farming systems.
2. Determine the relationship between microbial and nematode parameters over the growing season, particularly at times of organic inputs;
3. Determine the relationship between the rate of cover crop decomposition and nitrogen availability and microbial and nematode measurements;
4. Compare the ability of soils from low-input and organic versus conventional farming systems to withstand stresses associated with agronomic practices.

Abstract

The premise of this study is that sustainable farming practices need to address the below-ground, as well as above-ground, components of an agroecosystem. Thus the objectives were to develop an understanding of the structure and function of microbial and nematode communities associated with different farming management systems, to determine whether differences in soil biology are manifested in farming system properties, and to explore whether soil biology can be managed to improve farming practices. The study was carried out at the Sustainable Agriculture Farming Systems (SAFS) project at UC Davis comparing two- and four-year rotations (including tomatoes, safflower, corn, wheat/beans), managed using conventional, low-input or organic practices.

Major findings include the discoveries that :

Microbial populations are higher in size and activity in organic and low-input in comparison to conventional farming systems. Bacterial and fungal populations are greater in organic than conventional systems; however, fungi constitute a minor portion of the total microbial community in all systems. Bacterial-feeding nematodes are present at higher densities in organic than conventional soils, while plant parasitic nematodes are at lower numbers in organic systems. Bacterial-feeding nematodes are believed to play major roles in the fertility of farming systems relying on soil biological processes to provide soil fertility. A few species of bacterial-feeding nematodes dominate following incorporation of organic matter and thus overall diversity is lower in organic and low-input than conventional systems.

In organic amended systems, microbial populations rapidly respond to the addition of organic inputs, steadily increase until the mid growing season and then decline. Associated with increases in microbial populations are usually small increases in soil inorganic nitrogen. The dynamics of bacterial-feeding nematodes closely mirror microbial population dynamics. Those nematode species most successful at exploiting the microbial food sources in field plots are also important in stimulating nitrogen mineralization in laboratory studies. In organic corn and tomatoes, composted poultry manure appears unable to support crop demands for nitrogen in most years. Fertility from a combination of cover crops with mineral fertilizer in the low-input plots results in corn and tomato yields that are equivalent to or higher than in conventional treatments. The cover crop amendments appear to have prevented the degeneration of soil structure and reduction in water infiltration rates observed in the conventional soils.

Some of the differences between farming systems in soil fertility and structure are related to differences in soil biology. Microbial biomass is positively related to significantly higher water stable aggregation in

organic compared to conventional soils. Soil nitrate levels are significantly lower in organic than conventional tomato soils and are inversely correlated with microbial biomass levels in the organic systems. High microbial biomass and activity, and high numbers of bacterial-feeding nematodes grazing on and releasing nitrogen from the biomass, may provide sufficient nitrogen to crops without excessive accumulation of nitrate in soil.

Certain biological parameters are substantially enhanced in organic compared to conventional soils; however, the conventional soil is still very active biologically. Cover crops added to conventional soil decomposed at rates equivalent to those added to organic soils, suggesting that a long transition period is not necessary before soils can rapidly break down cover crops. Also, there was no difference in the carbon source utilization pattern of conventional and organic tomato soils.

Several approaches were developed to measure the impact of pollutant and environmental stresses on soil biology. Respiration of soil communities was severely impacted by the fumigant metam sodium at concentrations lower than typical usage rates, and recovery from exposure was slow. An aromatic pollutant associated with petroleum (toluene), however, had little impact on respiration, nitrogen mineralization, denitrification, and bacterial population density. The pollutant, however, strongly reduced nitrification rates and nitrifier populations, as well as impacted carbon source utilization patterns.

Site Information

The experiment was conducted on Yolo Silt Loam, a medium to heavy soil. The climate is Mediterranean with average summer day temperatures of 90°F. The majority of rainfall is between December and March with a yearly average of 25 inches. Irrigation water is above-average in quality and low in nitrate and minerals. The soils are fairly representative of the Sacramento Valley, as are the crops grown in the rotation.

Potential Contributions

One of the most evident benefits of this project is the development of new information on the management of farming systems receiving organic forms of fertilizer, particularly with respect to the importance of soil biota in crucial processes. Our research suggests that higher carbon to nitrogen ratios than previously thought acceptable may be beneficial in providing sufficient plant fertility while at the same time reducing soil nitrate levels. The outcome of this three-year study will help in the development of practical guidelines for organic fertilizer amendments.

Another important finding is that conventionally managed agricultural soils respond quickly to organic inputs and thus may rapidly develop large and metabolically active microbial populations in the presence of such inputs. We are continuing to assess the role of bacterial-feeding nematodes in nutrient cycling and identifying the most important species. We are currently evaluating whether stimulation of microbial and nematode activity in the fall can lead to better soil fertility in the early part of the growing season in organic farming systems. The results of these studies may support the development of guidelines on effectively managing soil communities to promote soil fertility.

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ACE #93-11

Calibration of the Pre-Sidedress Soil Nitrate Test to Improve Nitrogen Managemenpxt on Dairy Farms

Location:
Willamette Valley, Oregon

Funding Period:
June, 1993 - December, 1995

Grant Award:
$50,000

Project Investigators:
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Objectives

1. Calibrate the pre-sidedress soil nitrate test (PSNT) for use in predicting corn silage yield response to sidedressed N fertilizer on manured and non-manured soils in the Willamette Valley of Oregon.
2. Derive N fertilizer response functions to be used in developing published guidelines for sidedress N fertilization of corn silage.
3. Conduct educational programs to assist dairy producers in making more efficient use of N fertilizers and on-farm manure.

   Note: during the first year, we explored additional N tests (soil nitrate at planting, corn stalk nitrate at harvest, residual soil nitrate) and expanded our objectives to include the development of a N monitoring program for use by producers. After the first year, we found that the second objective could not be met because of a lack of N responsive sites from which to derive N fertilizer response functions.

Abstract of Results

Many dairies in Oregon's Willamette Valley grow silage corn for feed. Commercial nitrogen (N) fertilizers and dairy manure are often applied to the corn crop, though the fertilizer value of manure is often not considered. As a result, nitrogen is often supplied in excess of crop uptake, creating the potential for leaching of residual soil nitrate. The purpose of this project was to calibrate soil and plant analyses and develop a program whereby producers can monitor crop nitrogen status and evaluate nutrient management. Grower adoption of a nitrogen monitoring program will likely increase grower awareness of nutrient dynamics on the farm, result in significant economic savings from reduced fertilizer purchases, and reduce risk of nitrate movement to ground water.

Twenty-six experiments were performed on 17 farms in 1994 and 1995. Two predictive tests, soil nitrate at planting (SNAP) and the pre-sidedress soil nitrate test (PSNT), and two evaluative tests, corn stalk nitrate at harvest and residual soil nitrate, were calibrated. Sites were identified as N-responsive if yield from unfertilized plots was less than 94 percent of yield from plots receiving 200 kg N ha^{-1} sidedressed at the V5 or V6 growth stage.

The PSNT correctly identified 88 percent of the sites as having either sufficient or insufficient N for maximum yield. When PSNT concentrations were above 21 mg NO_3-N kg^{-1} soil, additional N was unlikely to improve yields. Twenty-two of 26 sites tested above the critical value. SNAP concentrations of 22 mg NO_3-N kg^{-1} soil or higher indicated that N was sufficient for maximum yield. SNAP concentrations below 22 mg NO_3-N kg^{-1} did not necessarily indicate N deficiency, and the SNAP test needed to be followed by a PSNT to assess the need for N fertilization.

Corn stalk nitrate concentrations at harvest were useful for identifying sites where insufficient, adequate, or excessive N had been supplied to the crop. A critical range of 3500 to 5500 mg NO_3-N kg^{-1} indicated an adequate N supply during the growing season. Residual soil nitrate concentrations above 16 mg NO_3-N kg^{-1} in the surface 30 cm (65 kg NO_3-N ha^{-1}) indicated N had been supplied in excess of crop demand. Comparison of at-planting and post-harvest concentrations of soil NO_3-N to a depth of 150 cm (5 ft.) showed that N applied as manure or N fertilizer was often in excess of crop requirements.

The small number of N-responsive sites in this study suggests that N from manure can replace most or all of the fertilizer presently applied to silage corn on many Willamette Valley dairies.

Site Information

Geographic area: The 17 cooperating farms were located in the Willamette Valley of western Oregon. The sites were spread along a 100 mile length of the valley. Climate: Mediterranean. Average annual rainfall is 40 inches, occurring primarily from Oct. through May. Soils: Alluvial 26 experiments: 23 silty clay, 3 silty clay loam. Farm size: Dairy herd sizes ranged from 60 to 1200 animals. Acreage in silage corn production ranged from approximately 60 to 300 acres.

Economic Analysis

Data suggest that many dairy producers can reduce or eliminate N fertilizer purchases. Elimination of N applications of 100 to 200 lb N/acre will save producers $35 to $70 per acre of fertilizer purchases plus application costs. A typical producer growing 100 acres of silage corn can reduce input costs by about $5000 while maintaining yields. One project cooperator reported fertilizer savings of $20,000 the first year of adoption of N monitoring techniques on 300 acres of corn. Elimination of fertilizer N applications on half of the valley's 16,900 acres of silage corn would reduce N use by 845,000 to 1,690,000 lb N per year, saving growers up to $500,000 annually.

Potential Contributions

This project demonstrates that dairy producers can reduce production costs, protect water quality, and maintain corn silage yield by using SNAP, PSNT and corn stalk nitrate, and residual soil nitrate tests to refine management of nitrogen applied as manure or commercial fertilizer. The most immediate impact will be the financial savings realized by the farmers. Society will benefit from grower adoption of this technology because ground water quality will be protected. By minimizing nitrate-nitrogen remaining in the soil profile at harvest, growers will be able to reduce over-winter leaching loss of nitrate.

Producers can make use of the plant and soil analyses calibrated in this project as components of a nitrogen monitoring program for silage corn production. While there is no need to make use of all methods in a single year, having an array of options should increase the likelihood that a given producer can develop a program that fits into his/her overall farm management program.

By monitoring nitrogen supply during corn production, growers can refine management over a period of years. Currently, manure application rates are calculated by balancing estimates of N supplied by manure with projected crop N removal. Monitoring N can improve management efficiency by detecting N sufficiency or deficiency on a site specific basis.

Evaluative tests such as corn stalk nitrate at harvest can aid growers working to reduce N fertilizer inputs. When growers reduce N fertilizer use and yields are lower than expected, reduced N rates may be the suspected cause. The stalk nitrate test at harvest can help determine if N was, in fact, the yield limiting factor. If the stalk nitrate test indicates N was not limiting, a grower may avoid returning to higher N rates unnecessarily. Similarly, a grower who has been successful at lowering N rates may use the stalk nitrate test to decide if further N reductions are advisable in future years.

Farmer Adoption

We expect that most dairy producers in western Oregon will eliminate or sharply curtail the use of N fertilizers on silage corn once these results have been widely disseminated. Reductions of N fertilizer application from 30 to 200 lb N/acre are highly probable.

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Final Results

Professional Development Program #94-003

Multidiisciplinary On-Site Training in Sustainable Agriculture

(Companion project to SARE #94-017)

Location:
Northern California

Funding Period:
January, 1995 - September, 1996

Grant Award:
$71,000

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Farmer Cooperators:
Jim Durst, Bruce Rominger, Ed Sills

Objectives

1. Develop multidisciplinary workshops on sustainable agriculture practices to train Farm Advisors, other extension personnel, USDA-Natural Resources Conservation Service field officers, and crop advisors using the UC Davis-based Sustainable Agriculture Farming Systems, SAFS, project as a "living laboratory."
2. Develop educational materials on sustainable agriculture for workshop participants that can be used by Farm Advisors, USDA-NRCS field officers, other extension personnel, and crop advisors as educational tools.
3. Develop outreach and educational programs to disseminate information from results of the first eight years of the SAFS project to target audiences.

Abstract of Results

In addition to two annual field days, the professional development component of the SAFS project has conducted four workshops to this point. A total of 186 agricultural professionals in 1995, and 190 so far in 1996, received in-service training from the Sustainable Agriculture Farming Systems project. These participants included representatives from Extension, USDA-NRCS, and various university and government sectors.

Two workshops were conducted on the project site in 1995. The workshops were designed with an intensive, innovative two-day format, in which participants learned specific research techniques, through hands-on experience, for evaluating sustainably managed farming systems. In Spring, 1996, a Cover Crop Management Workshop was conducted by the SAFS project, in collaboration with the University of California (UC) Cover Crop Workgroup. This two-day workshop was widely attended by 57 agricultural professionals, including representatives from UC Cooperative Extension, UCCE, NRCS, UC associated researchers and two other western region universities. In the Fall of 1996, a fourth workshop on "Soil Biology, Organic Matter Decomposition and the Soil Food Web" was held with a one-day format. It specifically focused on the impact of low input and organic farming systems on soil biology and nutrient cycling within the soil.

Educational materials were distributed at all workshops, which included several research publications, various tables and graphs, resource lists for alternative management methods, fertility management tools and methods as well as samples of cover crop seed and inoculants.

Two annual summer field days were held, each attended by over 125 participants. These included growers, farm advisors, international visitors and scholars, as well as students from throughout the state. These field days consisted of a field tour, update of recent findings, and several laboratory demonstrations. In 1996, an Agricultural Technology section was added to the field day to demonstrate the availability of sustainable agriculture information on the Internet.

Two different slide shows were produced in 1995. One was an overview of the project, including the goals, methods and experimental design, with general agronomic and economic results generated by the first eight years. The other was produced for the SAFS Principal Investigators to help in presentations at academic and industry meetings. These shows were continuously updated throughout 1996, as new

information from the project emerged. Extensive sections on fertility and soil biology were also added to the main project investigator slide set in 1996.

A video of the SAFS project complete. It includes an overview of the project, the experimental design, the participatory research process as well as all current findings. A Web site for the SAFS project is posted at: http://agronomy.ucdavis.edu/safs/home.htm. This includes the project description, experimental design, publications and abstracts, and current education and outreach events. Several other links are listed on the page, providing a gateway to over fifteen other Sustainable Agriculture web sites.

A quarterly SAFS Bulletin of Research Findings is planned for distribution to the target audience, as well the SAFS mailing list of over 1500 ag professionals statewide. Distribution will also occur regionally and internationally, through postings on the SAFS Web page and the national Sustainable Agriculture Network electronic mail group (an outreach project of the SARE program). The first bulletin, which describes the SAFS project and then focuses on soil biology, was mailed before September 1, 1996, to encourage interest in the upcoming soil biology workshop. Additional bulletins will cover such topics as: "Soil Fertility Management of Low-Input Corn" and "Weed Management in Low-Input Systems".

Positive Contributions

Workshop and field day participants gained exposure to the methods and results of the SAFS research project and had the opportunity to interact with the scientists, farm advisors and growers on the project team. In the workshops, participants were instructed in field sampling and lab analysis methods to evaluate soil health and quality, weed population dynamics, general fertility guidelines, and cover crop management. These workshops were presented using a small-scale, interactive, "hands-on" format to maximize the learning among participants. In addition, the participants were equipped with detailed educational manuals, complete with publications, resource lists, samples and methodology. The SAFS workshops have been continually improved upon, in response to evaluations and exchanged ideas among the SAFS team..

Reactions from Professionals

According to workshop evaluations, most participants responded enthusiastically to the methodology used and the results generated by the SAFS project. They also responded positively to the sampling and evaluation methods taught in the workshops, as well as the education packets provided. Some comments include:

—"I think this information is valuable in a classroom situation, field and garden. It is helpful in biomass management and soil protection".

—"I'll read the info provided and pass it along to growers, then work closely with those growers who show an interest".

Reactions from Farmers and Ranchers

Many growers and other agricultural professionals, who have attended these sessions, were clearly impressed with the information presented and learned the most from the grower panel discussions. A sample comment follows:

— "The panel discussion was a rare opportunity to hear about how growers go through the decision-making process involved with taking a slightly more sustainable or organic route."

Reported in 1996

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Final Results

Professional Development Program #94-006

Sustainable Agriculture Training Project: A Model of Collaborative Learning

Location:
Montana, Idaho, Eastern Washington and Utah

Funding Period:
October, 1994 - September, 1996

Grant Award:
$91,000

Project Investigator:
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Major Participants:
Farm and Ranch Improvement Clubs supported by AERO

Objectives

Train a cadre of trainers in five states, but primarily in Montana, who will a) deliver training programs in sustainable agriculture to technical assistance providers from public federal, state, local and private agencies and organizations, and b) develop partnerships with individual farmers/ranchers and farm improvement clubs to help them design, test and adopt more sustainable agricultural practices. Specifically:

1. Use the established three-state farm and ranch improvement club program as a primary source of training faculty—farmers, ranchers and their technical assistance providers and scientists.
2. Use the farm improvement clubs to model new roles and collaborative problem-solving relationships—among producers, between producers and technical assistance providers, and among technical assistance providers across agency/organization and state lines.
3. Introduce the training participants to the extensive farm and ranch improvement club network of farmers and technical assistance providers as an *ongoing* and *evolving* source of sustainable agriculture information, innovation, problem-solving and experience that they can access.
4. Develop and provide a variety of interactive training avenues, including individual and club farm tours, workshops, conferences, and regional meetings.
5. Provide the training participants with informational materials about region-specific sustainable agricultural technologies, research and demonstrations, and farmer innovation, and a directory to these and other resources.
6. Evaluate the impact of the training on the knowledge, behavior and relationships of the participants.

Abstract of Results

This training program targeted five states in the Intermountain Northwest: Montana, Idaho, Washington, Wyoming and Utah. All of the training events took place in Montana and were attended by agency and university personnel from all of the target states except Wyoming. Over 100 agency and land-grant college people participated in the training or portions of it.

A goal of this training was to model and foster new roles and relationships and build a strong network for collaboration in the traditional agriculture service agencies and land grant colleges. We also provided technical information pertinent to crop and livestock systems in the region. The year-long training included 1) a three-day conference in March, 2) tours of three exemplary Montana farms and ranches in June; 3) a conference on alternative weed management strategies in November; 4) the annual Montana Farm and Ranch Improvement Club annual meeting in December, and 5) a 1 1/2-day wrap-up session in December. Real life farmers and ranchers were an integral part of each step in the training process.

The first event focused on the principles of sustainable agriculture and collaborative inquiry. Second, the tours focused on how the principles can be put into practice—in a variety of ways and types of operations. The weed conference was very interactive and involved problem-solving by the audience working in small groups with practitioners and scientists. The December training focused on the experiences of the trainees themselves, as they work in the area of sustainable agriculture with producers and peers, and on on-farm research methods. The club annual meeting was a tremendous opportunity for all those working day-to-day toward a more sustainable agriculture to interact and learn from each other—producers, agency field staff, administrators, specialists and scientists.

A final evaluation to assess the long-term learning and impact on participants in the project was also done. We sent a survey to all participants, and got just 36 percent returned. The respondents were all people who began with a moderate to high level of commitment to sustainable agriculture. For the re-

spondents, this professional development program was generally successful. Both their individual explicit learning goals and most of the goals established in the training design were met. We designed the training to reach those most committed to sustainable agriculture and assist them in reaching a greater level of competence in their work and capacity to bring others in their agency along. However, our post-assessment was not completed by enough people to evaluate the overall effectiveness and impact of the program. But, we did get indications that all respondents increased their understanding of sustainable agriculture and their competency in several key areas. They also increased their contacts.

To help give us some context for interpreting our final assessment of our project's impact on the participants, we conducted a review of similar SARE projects around the country. We found some common dilemmas experienced in almost every program. Most striking were how overwhelmed project leaders ended up feeling by what they set out to do, and the resistance they encountered. All projects had difficulty creating a safe learning environment because of the gap between participants committed to sustainable agriculture and those who are skeptical. What we found to be the most successful strategies were also shared by other projects: case study problem-solving and on-the-ground farm experiences.

In summary, the most successful parts of our training were: 1) the heavy involvement of farmers and ranchers who are leaders in sustainable agriculture, and b) the opportunities for participants to build new networks through direct interaction with each other and those most knowledgeable about sustainable agriculture.

Potential Contributions

The trainees' interest and work in sustainable agriculture has gained credibility within their agencies as a result of the training program—both its content and its visibility. Besides increased credibility, the training program's impact is two-fold: 1) It has created the beginnings of a regional network of professionals working in the area of sustainable agriculture, for both support and information-sharing. This is something many farmers in the region have had through their membership in sustainable agriculture associations or organic certification chapters. Agencies and universities have been slower to evolve similar networks in support of their own personnel. These kinds of networks are critical for widespread change. 2) The trainees understand that systems changes are complex and require problem-solving skills and facilitation rather than simple question-answering. Through the training they are learning new approaches for serving the clientele and what their role is.

Almost all of the trainees at the March training worked actively with producers on sustainable agriculture and within their agencies in program development or staff training, and most collaborated with agencies other than their own.

Professional Adoption

After the March training, many participants implemented agency training opportunities and/or farmer-directed projects, and they credit the training with providing an impetus to develop their plans. As a result of the training series, the trainees know more about how sustainable agriculture is being developed on-the-ground in the region, giving them a better idea of what it is, why and how producers are pursuing it, and what their role might be.

Lessons for the Future

"There is no one best way to 'solve' farming practice problems, and farmers need to set the terms in experimenting with alternatives." — Natural Resource Conservation Service, NRCS, trainee identifying the most valuable things he learned from the farm tour portion of the training.

The training must cover not just what sustainable agriculture is and how to go about it, but how to best serve producers interested in it. This means acquiring both a) an understanding of new roles and processes of inquiry and support, and b) technical knowledge. Real life farmers and ranchers were an integral part of each step in the training process and were invaluable, as were the opportunities the training provided for interaction among the participants.

One thing we will change for next year is to combine the training on sustainable agriculture principles with the farm tours illustrating the practice of sustainable agriculture. In separating the two last year, we lost some continuity in audience. Those trainees that didn't attend both events lost much in understanding sustainable agriculture because the principles and practice were separated.

Many participants seemed less interested in the principles of sustainable agriculture. Instead, they wanted more emphasis on how to talk to constituents about sustainable agriculture—particularly those who may still be unfamiliar with it. In retrospect, we think a discussion about how to talk about sustainable agriculture may be a good way to cover the principles in a practical context. Many participants indicated a desire for more advanced training. However, participants had a wide range of experience and needs.

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Final Results

Professional Development Program #94-008

Pacific Northwest Sustainable Agriculture Systems In-Service Education Program

Location:
Oregon, Washington, Idaho, and Alaska

Funding Period:
August, 1994 - September, 1996

Grant Award:
$78,000

Project Investigator:
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Major Participants:
Cinda E. Williams and James Nelson, Agricultural Economics & Rural Sociology, University of Idaho; David Granatstein and Colette DePhelps, Center for Sustaining Agriculture and Natural Resources, Washington State University; and, Sheri Schneider, Natural Resources Conservation Service, Oregon.

Objectives

1. Implement a diversified, comprehensive educational program in sustainable agriculture principles and practices for Extension agents, Natural Resources Conservation Service (NRCS) personnel, private consultants, agricultural industry representatives and other agricultural professionals in Oregon, Washington, Idaho, and Alaska.
2. Develop, implement, and evaluate participatory processes relevant to the creation of a sustainable agriculture educational program for the Pacific Northwest agricultural professionals.

Abstract of Results

This four-state collaborative project in sustainable agriculture education has consisted of three linked components; (1) several in-service education workshops involving basic concepts of sustainable agriculture and specific information relevant to local cropping and ranching systems (with planning facilitated by our four-state coordinating team); (2) a four-state small-grants program for specific in-service education programs developed by local teams to meet local needs, and (3) a series of educational publications on participatory methods of learning.

The in-service education workshops included:

- "Agricultural Systems Assessment: Field Evaluation of Efficiency and Long-Term Productivity," July 25, 1995, Richland, WA;
- "Assessing and Managing Soil Quality," July 27, 1995, Aurora, OR; "Marketing Opportunities for Small Farms," May 20, 1996, Spokane, WA;
- "The Progress of Our Dreams: Assessing Sustainability for Communities Large and Small," October 8, 1995, Pullman, WA; and,
- a series of "Alaska Sustainable Agriculture Workshops" for all state extension agents and specialists.

The four-state, small grants program was designed to enhance local leadership in sustainable agriculture education around pertinent local issues. Requests for in-service education proposals in sustainable agriculture were distributed to more than 1,000 extension educators and specialists, agricultural agencies, agricultural industry representatives, producer, and non-profit groups. The grant program was also publicized in newspapers throughout the region. Nineteen proposals were received and reviewed in a two-tier review process involving farmers, NRCS and Extension personnel, and agricultural industry representatives. Topics of funded projects included:

- "Training Program on Cultural Management of Green Manure Crops;"
- "Alternative Lending Mechanisms for Sustainable Agriculture;"
- "Implementation of a Computer-based Decision-support System for IPM on Mint;"
- "The Grazing Manager: NRCS and County Extension Training;" "Sustainable and Global Marketing of Forages;"

- "Land Ethics and Agriculture;"
- "Dryland Agriculture in Eastern Washington in the Year 2020 and Beyond;"
- "Decision Cases for Professional Development;"
- "Use and Purpose of a Best Management Practices Handbook;" and,
- "World Wide Web Management Intensive Grazing Module."

A total of 13 educational programs were conducted in this project, with more 500 people involved as planners, instructors, or attendees. This project involved a diverse group of agricultural professionals in setting program priorities and in planning and conducting educational activities. Through these interactions, individuals were able to reach common working definitions of sustainable agriculture, and by working together, develop educational programs relevant to local and regional needs.

Dissemination of Findings

Resource materials developed for workshops have been disseminated to educational program participants, to the sustainable agriculture coordinators in Alaska, Idaho, Oregon and Washington, and to SARE. Additional copies of the materials have been distributed, by request, to individuals throughout the four-state region and are available for loan through the Center for Sustaining Agriculture and Natural Resources at Washington State University (WSU). Currently, WSU is in the process of making the resource materials available through a newly developed Internet web site. The web site will not only include citations, abstracts, and in some cases text of relevant resource materials, but also a searchable database of sustainability expertise in Washington. Through this electronic medium, we are providing both access to information and enhanced networking between agricultural professionals and the clientele they serve. The live satellite presentation of "The Progress of Our Dreams: Assessing Sustainability for Communities Large and Small" was down-linked by eight states and is being used in sustainability programming around the country. Currently over 50 video tape copies have sold.

The printing of seven new publications by Washington State University were partially funded by this project. They are designed to assist agricultural, natural resource and community practitioners undertaking community-based, applied research and education. (See "Sustainable Agriculture Resources" section.)

Potential Contributions

This highly-visible, four-state collaborative project in sustainable agriculture education involved a very diverse group of agricultural professionals in setting program priorities and in planning and conducting educational activities. Through these interactions, individuals were able to reach common working definitions of sustainable agriculture, and by working together, develop educational programs relevant to local and regional needs.

Another attitudinal shift that occurred during this project was the growing recognition of the importance of farmers and ranchers as educators. Traditionally farmers and ranchers are seen as the end-point of an information chain starting with university-based researchers. In this project, however, the leadership of many farmers and ranchers in developing sustainable practices was recognized and these individuals were involved as instructors.

Through this project, there has been an increased interagency participation in educational programming by Extension and the NRCS, since both organizations are involved with environmental quality and land stewardship issues. Many program participants have expressed that improved networking among agencies, states, farmers, and non-profit groups involved in this project has been an important benefit.

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Final Results

Professional Development Program #94-009

Permaculture Systems Pamphlet

Funding Period:
October, 1994 - December, 1995

Grant Award:
$5,620

Project Investigator:
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Central Rocky Mountain Permaculture Institute
PO Box 631
Basalt, Colorado 81621
Phone: (303) 927-4158

Major Participant:
Sandy Cruz, High Altitude Permaculture Institute

Objective

The project's primary objective was to produce a pamphlet which explained permaculture principles. Specifically, the pamphlet was targeted at farmers, ranchers and gardeners to whom the concept of permaculture was new. The brochure was to touch on ethics, economics, design, sustainability and natural succession.

Permaculture is a combination of the words "permanent" and "agriculture." The term refers to a sustainable approach of meeting human needs through the construction of productive ecosystems which do not degrade the natural environment. Permaculture sites integrate plants, animals, landscapes, structures and humans into symbiotic systems where the products of one element serve the needs of another.

Abstract of Results

The six-page pamphlet on permaculture was completed using feedback from a variety of reviewers. It was distributed and promoted by both the Institute and the Western SARE Professional Development Program. (See "Sustainable Agriculture Resources" section.)

Potential Contributions

A recent permaculture design course included the pamphlet in its literature, and it was one of the most widely reproduced handouts. The students universally noted the philosophical and practical emphasis of the pamphlet.

Reaction from Farmers and Ranchers

Although we have received little direct feedback from the farming and ranching communities, Susan Mullen, a permaculture educator in Gila, New Mexico, presented an earlier draft of the pamphlet at a meeting between ranchers and the Nature Conservancy. The ranchers found the pamphlet to be very informative and requested copies of the final version. Additionally, guest lecturers during the Institute's ninth annual design course, Chris Holstrom (Tomten Farm), Dennis Stenson (Happy Heart Farm), John Cruixshank (Sunrise Ranch), Michael Moore (Twin Oaks), Dan Howell (Running Rain Society) and Ken Kuhns, all reviewed the pamphlet and noted its universal audience, clear explanation of principles and excellence as a teaching tool.

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Final Results

Professional Development Program #94-014

Training "Agents" in On-Farm Implementation of Sustainable Management Systems for Tropical Agriculture in Hawai'i and the Pacific Region

Location:
Hawaii, Guam, American Samoa, Micronesia, and the Commonwealth of Mariana Islands

Funding Period:
October, 1994 - September, 1996

Grant Award:
$89,000

Project Investigators:
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Objectives

Develop Extension training curricula emphasizing the paradigm of sustainable agriculture under island eco-systems; and, train extension agents and other field-level agriculture professionals to enable them to help farmers implement sustainable agriculture strategies at the field level in tropical areas of the western region.

Abstract of Results

In 1995, twenty Cooperative Extension agents and Natural Resources Conservation Service, NRCS, field staff from the Hawaii, Guam, American Samoa, Micronesia and the Northern Mariana Islands were selected and trained in the 1995 "Train the Trainers" program. Instruction in concepts and practices of sustainable agriculture was provided in three intensive, week-long sessions, held on Maui, Oahu and in Kona, Hawaii. The most popular training topics included methods of accessing sustainable agriculture information on the Internet, integrated aquaculture systems, conducting on-farm research and biological control in the Pacific. Upon returning to their home islands, agents have offered workshops and established demonstration sites, using knowledge gained in the training.

Based on written evaluations of the 1995 training program, and the research and education needs identified in state/territory strategic plans, a second year training has been designed, emphasizing more hands-on training in diverse locations in the Pacific region. Funding for the second-year program, provided by Western SARE and the USDA Agricultural Development in the American Pacific program, will be used to establish on-farm demonstration sites and workshops on sustainable agriculture management skills and practices in Hawaii, Guam and Pohnpei (Micronesia).

Specific Activities

The 1995 program was specifically directed towards enabling agents to help farmers implement sustainable agriculture strategies at the field level in tropical areas of the western region.

The first training session was held at the University of Hawaii-Manoa's NiFTAL

(Nitrogen-fixing Tropical Agriculture Legumes) station in Paia, Maui, from June 26-30, 1995. Participants were introduced to the sustainable agriculture paradigm which emphasizes applying ecological principles to preserve biodiversity, soil and water resources on farms. Included in this session was a discussion on the indicators of sustainability, such as the health and safety of the farming community. Case studies of successful on-farm research teams in Washington state included ideas for integrating university and farmers in sustainable agricultural research.

Participants were introduced to Internet resources for more information on sustainable agriculture, including the SARE program's Sustainable Agriculture Network, SAN, Web site and e-mail discussion group, sanet-mg; and, the University of California Sustainable Agriculture Research and Education's, (UC SAREP) cover crops data base; among other related Web sites.

The second training session was held in conjunction with the MODSS conference (Multiple Objective Decision Support Systems) from July 23-28, 1995, in Honolulu. Over 200 representatives from 20 different countries obtained hands-on experience with the latest computer technology used in stimulating

environmental situations which involved decision nodes. Included in this conference were software packages for site-specific herbicide and manure application. The Pacific Island group also participated in a session on "Sustainable Agriculture in Hawaii and the Pacific" with Western SARE Regional Coordinator Phil Rasmussen, Ph.D., and former national SARE director, Alice Jones, Ph.D. Agents concluded from this session that there are many similar problems across the region, including poor volcanic soils, limited water resources, pollution of ground and ocean waters from agricultural run-off, and lack of site-specific information on sustainable agriculture practices for the tropics..

Trainees met for a final time in Kona, Hawaii, from August 28-September 1, 1995, to further address commodity-specific needs. Classes were presented on aquaculture, soil nutrition, agroforestry, sustainable vegetable production and research, biological control and least-toxic pest management, tropical fruit tree culture, integrated livestock management, and organic food crop certification, among other topics. Farm tours were also conducted; they included visits to an organic coffee farm, a hog operation utilizing deep-litter (which becomes compost for the market crops on the farm), and several vegetable farms demonstrating soil and water conservation techniques.

Reactions from Professionals

Trainees responded in their evaluations that more information was needed in 28 of the 30 classes offered during the training sessions. (A 40 percent return rate on evaluations were achieved.) Classes that rated the highest included aquaculture systems, least-toxic pest management, integrated livestock management, agroforestry and improving soil fertility in the tropics. Based on these suggestions, a second-year training program has been developed on these topics.

An agent from Hawaii wrote, "I think Extension agents do not have enough opportunities to train each other; I know I enjoyed my opportunity." Another agent commented on the benefit derived from the close interaction with fellow agents during the sessions, writing, "I hope this is just the beginning of an equal partnership beneficial to all our clients in the Pacific."

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Final Results

Professional Development Program #94-018

Extension Sustainable Agriculture Training in Eight Western States

Location:
Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah and Wyoming

Funding Period:
October, 1994 - July, 1996

Grant Award:
$75,000

Project Investigator:
Joe Hiller
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Major Participants:
Dennis Lamm, Jody Lippmann, Colorado State University; Scott Cotton, University of Wyoming.

Major Cooperators:
Mike English, New Mexico State University; Hudson Glimp, University of Nevada/ Reno; James Johnson, Montana State University; James R Nelson, University of Idaho; James C Wade, University of Arizona; Ralph Whitesides, Utah State University.

Farmer & Rancher Cooperators:
Lydia Poulsen, Snowville UT
Barb Smith, Iowa City, IA
Jack Turnell, Meeteetse, WY

Objectives

1. Provide increased awareness of the concepts and principles of sustainable agriculture.
2. Share information on projects, needs, expertise and resources throughout the region.
3. Encourage the development of regional links, e.g., partnerships, leadership and networking.

Abstract of Results

The purpose of this project was to provide a forum for a target group of 300-400 Extension and agricultural professionals. The forum allowed them to discuss sustainable agriculture concepts, helped them focus on a definition of sustainable agriculture that was applicable in their field, and encouraged the sponsorship of sustainable agriculture concepts and practices.

Two educational programs were developed and packaged as nationally broadcast satellite transmissions. They were advertised via state Extension channels, mailed advertisements and electronically on the Internet. Both broadcasts were duplicated in KU and C band formats to ensure broad reception. Satellite reception and participation were offered to any interested parties, including Extension staff, conservation district members and university faculty. The Natural Resources Conservation Service (NRCS) encouraged their employees in the eight-state region to participate and Extension personnel were instructed to invite the participation of as many producers and private resource managers as possible.

The first program was a live teleconference in which four speakers gave commentary and was broadcast on January 30, 1995, from Colorado State University. Live telephone calls precipitating open discussion were fed to both the speakers and an ancillary, three-member panel. The initial commentary took forty-five minutes; numerous calls took up the remainder of the ninety minute program. Viewers and participants throughout the eight state area interacted from sites in Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah and Wyoming. Additional sites, requesting participation as a result of the advertisements, were linked up as requests arrived.

Within the original target group, the program was broadcast to a total of 140 sites in the eight western state area, reaching 1,919 viewer/participants. Participants included Extension staff, NRCS, other agency representatives, and conservation district personnel, as well as producers and members of special interest groups.

The second program was a videotaped presentation that aired on April 10, 1995. This program was a collaborative effort between the University of Wyoming and Nebraska Educational Television. It contained short segments of sustainable agriculture showcase projects from Colorado, Montana, Nevada, New Mexico, Utah and Wyoming that demonstrated individual and diverse applications of sustainable agriculture practices.

Taped copies of both programswere made available to all collaborative groups and to any other interested parties on a cost basis. Colorado, Wyoming and a number of the other participating states used the live broadcasts or taped copies to help facilitate meetings to develop in-state strategic plans for sustainable agriculture.

Positive Contributions

Producers in several of the western states have recognized parallel efforts in other states and have undertaken collaborative contact efforts as a direct result of this project. This includes: hay producers on the Wind River Indian Reservation in Wyoming contacting hay purchasers on the Navajo Reservation; Guam fruit growers contacting University of Wyoming faculty about potential pest controls; Hawaii and Wyoming graziers exchanging information about using prescribed goat grazing to control weeds, etc.

More significantly, however, is the growing understanding within the national professional resource management community that sustainable agriculture is much like the concept of conservation: it is site-specific and must be conformed to ecosystem, operation and location in each instance. We are continually receiving additional feedback from the regions where the information was distributed.

Reactions from Farmers and Ranchers

Some producers have indicated that they can now recognize sustainable agriculture practices and realize there is a need to modify existing production approaches. They requested the development of "comprehensive management systems" that can incorporate sustainable agriculture concepts on a site-by-site basis. Producers in Wyoming, Colorado and New Mexico indicated that they felt the second program was more useful.

Reported in 1996

Western Region SARE Grants Awarded in 1995

State-by-State or Island Protectorate

Western Region
Sustainable Agriculture Research and Education

State	Grant Recipient	Award	Subject
Alaska	Vickie Talbot, producer	$ 5,000	Forest Land into Ag Use
	Total Funding for Alaska:	*$ 5,000*	
American Samoa	Juan Chan, producer	$ 721	Composting from Farm & Kitchen
	Malo Palesco, producer	$ 2,765	Sustainable Agroforestry System
	Felalai Lefee, producer	$ 1,400	Banana Scab Moth Caterpillar
	Total Funding for American Samoa:	*$ 4886*	
California	Frank G. Zalom, University of California (UC),	$122,559	Cover Crop System for Grapes
	Davis Harry H. Shorey, UC Kearney Agricultural Center	$120,770	Pest Control by Pheromones
	Fenton P. Wilkinson (see Washington)	(see WA)	Sustainable Community Food Sys
	Kate Scow, University of California	$175,000	Enhance Soil Fertility
	Charles J. Rivara, California Tomato Research Inst.	$ 40,000	Tomato Pest Control
	Liza Lewis, producer	$ 5,000	Sustainable Walnut Production
	Jackelyn Lundy/Sean Swezey, UC Santa Cruz	$ 20,000	Sustainable Ag Training Program*
	Total Funding for California:	*$483,329*	
Colorado	Steve Guldan (see New Mexico)	(see NM)	Extending the Grazing Season
	Ian V. MacRae, Colorado State University	$ 36,091	Alfalfa Microbial Pest Control
	Joe Kinnie, producer	$ 5,000	Dryland Multi-crop Rotations
	Total Funding for Colorado:	*$ 41,091*	
Hawaii	Craig Elevitch, Source Ecosystems	$ 30,430	Orchard Alley Cropping
	Total Funding for Hawaii:	*$ 30,430*	
Idaho	Charlotte Eberlein, University of Idaho	$112,580	Brassica Green Manure Systems
	Patrick A. Momont, University of Idaho	$ 42,070	Riparian Area Cattle Grazing
	Wesley W. C. Chun, University of Idaho	$ 36,700	Potato Ring Rot Disease
	Larry Sorenson, producer	$ 5,000	Bio Control in Alfalfa Seed Fields
	Lee R. Griffiths, producer	$ 530	Weed Suppression by Row Spacing
	Janie Burns, producer	$ 4,622	Marketing Cooperative for Local Produce
	Jill Kohler, producer	$ 2,740	Squash Bug Management
	Total Funding for Idaho:	*$204,242*	
Montana	Randy Tunby, producer	$ 4,943	Range and Livestock Production
	Helen Atthowe, producer	$ 5,000	Living Mulch in Vegetable Production
	Allen Carter, producer	$ 4,750	Elk & Livestock Riparian Use
	Nancy Matheson, Alternative Energy Resources Org	$ 31,450	Sustainable Ag Training Project*
	James E. Knight, Montana State University	$ 98,000	Riparian Areas Management*
	Roger L. Sheley, Montana State University	$ 43,800	Sustainable Rangeland Weed Mgmt*
	Total Funding for Montana:	*$187,943*	
Nevada	Hudson Glimp & Ben Bruce, Univ of Nevada, Reno	$106,720	Integrated Range Livestock & Crop*
	Total Funding for Nevada:	*$106,720*	

State	Grant Recipient	Award	Subject
New Mexico	Steve Guldan, New Mexico State University	$141,602	Extended Grazing Season
	Joe Ellington, New Mexico State University	$ 40,000	Cotton Insect Control
	Lonnie Roybal, producer	$ 5,000	Organically Produced Small Grains
	Pete Tatschi, producer	$ 4,290	Sludge & Legumes as Soil Builders
	Matt Schneberger, producer	$ 5,000	Elk Effect on Riparian Areas
	Howard Shanks, So. Central Res Conserv & Devl Cncl	$ 24,000	Pinyon-Juniper Watershed Mgmt*
	Total Funding for New Mexico:	***$219,892***	
Oregon	Richard Dick, Oregon State University	$180,000	Soil Quality Management
	Patrick A. Momont (see Idaho)	(see Idaho)	Riparian Area Cattle Grazing
	Glenna Wilder, producer	$ 1,225	Management of Composted Manure
	Jim Fullmer, producer	$ 1,600	Low Tillage Weed Control
	Thom Nelson, producer	$ 5,000	Integrated Pear Production
	J.J. Haapala, producer	$ 5,000	Microbial Degradation of Soil Residues
	Total Funding for Oregon:	***$192,825***	
Utah	Randall D. Wiedmeier, Utah State University	$ 60,000	Livestock Production/Public Lands
	D. Layne Coppock, Utah State University	$ 63,000	Sustainability of Public-Land Grazing
	Ken Carter, producer	$ 2,480	Pasture Aeration and Fertilizer
	Total Funding for Utah:	***$125,480***	
Washington	Fenton P. Wilkinson, Sustainable Options	$ 59,448	Sustainable Community Food Systems
	Charlotte Eberlein (see Idaho)	(see Idaho)	Brassica Green Manure Systems
	Craig Boesel, producer	$ 5,000	Managing Riparian Areas
	R. Bruce Gregory, producer	$ 898.50	Grazing in Asian Pear Orchards
	Jerry Van der Veen, producer	$ 5,000	Cover Crops for Corn Production
	Total Funding for Washington:	***$70,346.5***	
Wyoming	Michael A. Smith, University of Wyoming	$155,260	Sustainable Rangeland Cattle Production
	Ogden Driskell, producer	$ 5,000	Integrated Rangeland Management
	Tom Bruce, producer	$ 5,000	Initiation of Integrated Management
	Stan & Mary Flitner, producer	$ 5,000	Wetland Habitat Enhancement
	Joe Hiller & Scott Cotton, University of Wyoming	$ 20,000	Sustianable Ag Video Education*
	Total Funding for Wyoming:	***$190,260***	

*These projects have a specific goal to provide professional development opportunities for Extension and Natural Resources Conservation Service personnel, and other agricultural professionals.

Note: A high number of professional development grants have multi-state involvement. The state named is home to the contracting institution.

Western Region SARE Grants Awarded in 1996

State-by-State or Island Protectorate

Western Region
Sustainable Agriculture Research and Education

State	Grant Recipient	Award	Subject
Alaska	Vickie Talbot, producer	$ 3,000.00	Forest Land into Ag Use
	Total Funding for Alaska:	*$ 3,000.00*	
American Samoa	Tovia Tuli, producer	$ 5,000.00	Pig Manure Control
	Total Funding for American Samoa:	$ 5,000.00	
Arizona	Wayne Coates, University of Arizona	$121,000.00	Cultivation & Banding of Herbicides
	Steve Getzwiller, producer	$ 3,000.00	Lovegrase
	Kali Holtschlag, producer	$ 4,310.00	Riparian Management
	Mike Mercer, producer	$ 2,500.00	Managing Biological Processes
	Total Funding for Arizona:	*$130,810.00*	
California	Steve Temple, University of California, Davis	$ 44,185.00	"Living Lab" of Sus. Ag.*
	David Chaney, UC Sus. Ag. Research & Education Program	$ 98,773.00	Curriculum Approaches*
	William Olkowski, Bio-Integral Resource Center	$ 29,000.00	Public Lands & Reserves*
	Mike Spezia, Community Alliance with Family Farmers	$ 77,970.00	Sustainable Tree Crops*
	Craig McNamara, producer	$ 5,000.00	Farm Management
	Lee Jackson, University of California, Davis	$200,000.00	Tomatoes (farming systems)
	Louise Jackson, University of California, Davis	$102,000.00	Tillage for N Cycling & Soil Quality
	David Pratt, University of California Cooperative Extension	$ 40,750.00	Controlled Grazing
	Total Funding for California:	*$597,678.00*	
Colorado	Jessica Davis, Colorado State University	$ 60,000.00	Livestock Operations*
	Bob White, producer	$ 1,500.00	Apples (pest control)
	Jessica Davis, Colorado State University	$206,000.00	Manure Management
	Total Funding for Colorado :	*$267,500.00*	
Guam	George Pangelinan, producer	$ 4,350.00	Swine Feeding
	Felix Quan, producer	$ 3,020.00	Vegetable Soybean
	Total Funding for Guam:	*$ 7,370.00*	
Hawaii	Shari Tresky, producer	$ 3,520.00	Greenhouse Tomatoes
	Susan Schenck, Hawaiian Sugar Planters' Association	$ 49,595.00	Asparagus
	Total Funding for Hawaii	*$ 53,115.00*	
Idaho	Paula Jones, Natural Resources Conservation Service	$ 15,400.00	Leafy Spurge Control
	Larry Higgins, producer	$ 2,450.00	Greenhouse Solarization
	Total Funding for Idaho:	*$ 17,850.00*	
Montana	Rod Daniel, producer	$ 1,923.15	Cover Cropping
	Jess Alger, producer	$ 4,000.00	Grazing & Feed Rotations
	Robert Lee, producer	$ 4,800.00	Pasture Management
	Nancy Matheson, Alternative Energy Resources Organization	$124,425.00	Farm Improvement Clubs
	Dale Veseth, producer	$ 2,500.00	Alternative Water Sources
	Total Funding for Montana:	*$137,648.15*	

State	Grant Recipient	Award	Subject
New Mexico	Darrell Baker, producer	$ 4,200.00	Irrigated Pastures
	Lonnie Roybal, producer	$ 5,000.00	Organic Small Grains
	Craig Mapel, New Mexico Department of Agriculture	$100,000.00	Sustainable Ag in South Colorado
	Total Funding for New Mexico:	*$109,200.00*	
Oregon	Ray William, Oregon State University	$ 40,000.00	Symphylans (pest control)
	Jim Fulmer, producer	$ 1,895.00	Low Tillage Weed Control
	William Booth, producer	$ 2,620.00	Composting (disease control)
	Dave Michul, producer	$ 2,930.00	Grapes
	Jack Gray, producer	$ 2,610.00	Blueberries and Tomatoes
	Tom Lehman, producer	$ 1,575.00	Grazing Sheep
	Devon Strong, producer	$ 3,000.00	Cafeteria Compost System
	Jeff Boden, producer	$ 2,500.00	Rhubarb (weed control)
	Franz Niederholzer, OR State University Extension Service	$ 58,290.00	Pear Production
	Total Funding for Oregon:	*$115,420.00*	
Utah	David Hole, Utah State University	$ 93,911.00	Organic Hard-Winter Wheat
	Total Funding for Utah:	*$ 93,911.00*	
Washington	Diana Roberts, Washington State University	$ 36,424.00	Sus. Ag. Seminars*
	Robert Gillespie, Washington State University	$ 61,485.00	Wildlife & Beneficial Insect
	Miles McEvoy, Washington State Department of Agriculture	$ 17,050.00	Organic Resource Guide*
	Gene Tinkelberg, producer	$ 4,230.00	Relay Intercropping
	Gary Holwegner, producer	$ 2,550.00	Organic Apples
	Karl Kupers, producer	$ 4,400.00	Alternative Crop Production
	Betsie DeWreede, producer	$ 1,150.00	Carrot Rust Fly Control
	Julie Matthews, producer	$ 2,750.00	Sustainability in Hay Fields
	Nils Sundquist, producer	$ 4,575.00	Organic vs Synthetic Fertilizer
	Total Funding for Washington:	*$134,614.00*	
Wyoming	Jeff Powell, University of Wyoming	$ 94,475.00	Riparian Vegetation Filters
	Matt Weber, producer	$ 2,800.00	Grasses for Grazing
	John Hewlett, University of Wyoming	$ 36,326.00	Ranch/Farm Education
	Jim Krall, University of Wyoming	$ 95,100.00	Corn/Annual Medic Intercrop.
	Total Funding for Wyoming:	*$228,701.00*	

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